CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Introduction

This chapter provides information concerning the existing environment of the Lyman project area, and potential consequences to that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2. Each resource potentially affected by the proposed action or alternatives is described by its current condition and uses. These resource descriptions also include descriptions of and reasons for the spatial and temporal boundaries of cumulative effects analyses. Existing base line, or benchmark, conditions and possible thresholds are also indicated.

Following each resource description is a discussion of the potential effects (environmental consequences) to the resource associated with the implementation of each alternative. All direct, indirect, and cumulative effects are disclosed. Effects are quantified where possible, and qualitative discussions are also included. The means by which potential adverse effects would be reduced or mitigated are described (see also Chapter 2).

Direct environmental effects are those occurring at the same time and place as the initial cause or action. Indirect effects are those that occur later in time or are spatially removed from the activity. Cumulative effects result from incremental effects of actions, when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. A complete list of all management activities considered within and near the Lyman analysis area is included in the Project File. Resource specialists that reviewed effect analysis used this list as a “menu” to define their cumulative effects analysis. Listed activities not addressed in the cumulative effects analysis were determined to have no or negligible cumulative effects.

The discussions of resources and potential effects take advantage of existing information included in the Bitterroot Forest Plan’s FEIS, other project EA or EISs, project-specific resource reports and related information, and other sources as indicated. Where applicable, such information is briefly summarized and referenced to minimize duplication. The planning record for the Lyman Project includes all project-specific information, including resource reports, and other results of field investigations.

There is less than complete knowledge about many of the relationships and conditions of wildlife, fish, forests, jobs and communities. The ecology, inventory and management of a large forest area are a complex and developing science. The biology of wildlife species prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science. However, the basic data and central relationships are sufficiently well established in the respective sciences for the deciding official to make a reasoned choice between the alternatives, and to adequately assess and disclose the possible adverse environmental consequences. New or improved information would be very unlikely to reverse or nullify our understanding of these relationships.

SOILS

Regulatory Framework

The Bitterroot National Forest Land and Resource Management Plans and FSM 2500, Sections 2520 and 2550, provide direction for the management of soils within activity areas. This direction can be found in the following documents (refer to the Project File, SOILS-9):

- The Bitterroot Forest Plan (USDA Forest Service, 1987)
- Forest Service Manual and Handbook Direction (FSM 2554, FSH 2509)
- FSM 2500 – R-1 Supplement No. 2500-99-1
- FSM 2500 – BNF Supplement No. 2550-01-1
- Montana State Guidelines for Best Management Practices (BMPs)
- Executive Order 11990

Area of Analysis

The analysis area for soils encompasses all land within an individual unit. If an effect is expected to be larger than an activity unit, the project boundary will be used for analysis. Soils outside this area will not be directly or indirectly affected by this proposal. For the same reason, the project area boundary is also the analysis area for cumulative soils effects. Effects on soils are closely interconnected with effects to streams. The potential for runoff and surface soil erosion is addressed in the Watershed section of this document.

Data Sources and Protocols

Sources of information include:

- Soils within the analysis area have been mapped and are described in the Bitterroot National Forest Land System Inventory (soil survey) (McBride, In progress 2003). This inventory, which meets the standards of the National Cooperative Soil Survey, describes soil map units, landforms, and vegetation components, and provides interpretive information on soil use and management.
- The forest hydrologist conducted a soil condition inventory on 12 proposed treatment areas utilizing The Bitterroot National Forest Draft Soil Quality Condition Survey Protocols (Draft March 2003) or a walk through survey. Field survey results and protocols are included in the Project File, SOILS-4 and SOILS-5.
- GIS soil maps, Project File SOILS-2 and SOILS-5.
- Lyman Salvage Sale planning file.

Existing Condition

SOIL CHARACTERISTICS

The Lyman planning area contains soils and landforms typical of the Sapphire Mountains of Western Montana. Units are located on the ridgetops and shoulders of dissected, moderately steep, and steep mountain slopes. Slopes range from less than 10 to greater than 40 percent. Dissected mountain slopes are very efficient at transporting water and sediment (Holdorf and Donahue 1990). Their thin soil mantle has limited water storage capability that may result in runoff and debris avalanching in low order drainages. The moderately steep and steep mountain slope landforms are slightly convex so water is dispersed resulting in a relatively stable watershed (Holdorf and Donahue 1990). Drainage channels originate at seeps or springs that emerge near the base of the ridge shoulder.

Soils form a mosaic across the landscape and reflect variations in topographic position, bedrock, vegetation, and climate (details on the soils found in the planning area are found in the Project File, SOILS-1, SOILS-2, SOILS-3 and SOILS-5). Area soils have developed primarily from moderately to highly weathered granite and gneiss. The majority of soils are Inceptisols, either Ustochrepts or Cryochrepts. Alfisols are also represented, primarily Haplustalfs and Cryoboralfs. No andic (ash) soils have been identified in the planning units. Inceptisols are thought to form rapidly from the alteration of parent materials (Brady 1980). Alfisol soils have a distinct horizon of accumulated silicate clays and are more weathered than Inceptisols.

Generally, parent material weathering and soil development is slow given cool and cold temperature regimes and relatively low moisture during the growing season. Cryic temperature regimes are found in high elevation Douglas-fir, lodgepole pine, and subalpine habitats and north aspects. The Ustic moisture regime indicates intermittently wet/dry summer conditions common to mid elevation Douglas-fir sites.

Soil textures are gravelly to very gravelly sandy loams with a moderate to high susceptibility to surface soil erosion due to soil particle sizes and the lack of soil cohesion. Soils on the shoulders and noses of ridges tend to be shallow (10-20 inches deep); elsewhere soil depth can exceed 40 inches. Pea gravels are common in the surface horizons.

Soils formed in highly weathered, coarse-grained granite, "gruss", are the most infertile soils on the forest with low water holding capacity (Units 1, 2, 3, 7, 8, 9, 10, 13, 14, 15 and portions of Units 4, 5, 6, 12). Soils in the remainder of the planning units, Units 11, and portions of 4, 5, 6 and 12, are formed from volcanics, gneiss and slightly to moderately weathered granite parent materials. These soils have slightly finer texture and increased water holding capacity but are still relatively infertile.

SOIL PRODUCTIVITY

Sheet, Rill, Gully, and Landslide Erosion

Soil erodibility is a function of detachability, infiltration rate, permeability of lower horizons, uniformity of slope and slope percent, water concentration potential, distribution of annual precipitation, rainfall intensities, soil temperatures, and the density of effective ground cover. Soil erosion is a natural process that can be accelerated by land management activities or wildfire. Soils on steep slopes with poor vegetative cover and lack of structural development are more susceptible to erosion than are soils on flatter terrain. Vegetation, including the organic horizon, protects the soil surface from raindrop impact, dissipates the energy of overland flow, and binds soil particles together (Brady 1980).

The Bitterroot Post-Fire Assessment (December 2000) identified landscapes within the 2000 fire that have inherent instabilities, including breaklands, convergent stream headlands, and glacial troughs. Lyman project Unit 12 has breakland landforms in the north and central portion of the unit. This unit would be logged using skyline cable systems due to the steep ground.

Even though the coarse-textured soils (all units) have with a moderate to high susceptibility of surface soil erosion due to soil particle sizes and the lack of soil cohesion, no accelerated or widespread sheet or rill erosion was noted in the sale units inventoried (2003- Soil Condition Surveys, Project File – SOILS-5). Sheet and rill erosion related to the fires of 2000 was noted in localized locations in all the units. These locations correspond to areas of severe fire. In the two growing seasons since the fires, these areas have stabilized with the re-establishment of ground cover, moss, lichens, grass/forb, and needle cover. In most cases any current soil movement is being stored in microsites on the hillslope. Only where the bare ground is immediately adjacent to a channel is soil moving off-site. Map III-1 shows burn severity mapped immediately following the fires of 2000.

Overland flow and debris flows were identified in Cameron Creek following the fires of 2000. Over 450 acres of log erosion barriers and wattles were installed after the fires to reduce overland flow. Field review found that fire related sediment was deposited in ephemeral draws and intermittent channels and is slowly being released and routed downstream. An increase in down wood and the re-growth of vegetation along the channel banks is providing inchannel storage sites.

Debris flows can be triggered in low order stream channels as a result of summer thunderstorms. No debris flows were noted in or adjacent to potential Lyman harvest units (2003 Soil Condition Surveys).

Fires can have an effect on slope stability (USFS December 2000). Tree mortality reduces evapotranspiration, altering soil moisture regimes. As roots decay, soil strength is further reduced. This combined with steep slopes can result in loss of slope stability. No landslides or large mass wasting events were noted in this area after the Fires of 2000 (2003 Soil Condition Surveys). Units 5 and 9 are located on old landslide features. Scarps, seeps, and springs are common on the hillslope. Trees growing on the site prior to the fires of 2000 did not indicate recent activity in the landslides, as there were few “pistol butt” or leaning trees noted. Because the fire burned hot on the south facing slopes of Unit 5, changes to the hydrologic and soil-moisture regime are expected. Unit 9 was a light underburn for the most part. Currently the unit is fully stocked however many of the trees are dying due to insects. Due to insect activity a change to the hydrologic and soil-moisture regime is expected in this unit also.

MAP III-1 BURN SEVERITY

Organic Matter and Large Woody Material
Moisture and nitrogen are limiting factors for soil productivity. Nutrient recycling and decomposition rates are slow in this cold-dry environment. Soil nutrients are primarily replenished through the decomposition of organic matter and root turnover (Brady 1980). Where the fires of 2000 burned with high severity, much of the nutrient capital was volatilized (especially nitrogen and sulfate) (DeBano 1990).

Moisture stress, especially during the late summer, is common in these coarse-grained soils. Loss of organic matter (including duff) because of the fires further confounds this condition.

In most units, organic matter (surface litter and duff) depth approximates 1-11/2 inches (2003 Soil Condition Surveys, SOILS-5). Ground cover (large rock, duff, surface litter, and plant cover) averages greater than 60% except in Units 5 and 4 where the fire was more severe. Prior to the fires, organic matter in the top six inches of soil averaged 3-5 percent of the soil volume with a duff depth of 1-3 inches (USDA December 2000). Research from the Sleeping Child burn found herbaceous cover to increase up to five percent a year for the first 2 years (Lyons 1976 and 1984). Lyons (1976, 1984) further found herbaceous plant cover to approximate 15 percent by year 3, 20-25 percent by year 6, and 60 percent by year 10. This is consistent with the percent ground cover sampled during the 2003 Soil Condition Surveys, SOILS-5.

Amounts of down coarse woody material (>4 inches diameter) are variable across the units (2003 Soil Condition Surveys, SOILS-5). Recommended levels of organic matter and coarse woody debris (cwd) are specified in Table 2-4 Management Requirements and Mitigation Measures.

Potential future down wood recruitment is high because of the Fires of 2000. The size class for this future down wood is in all size ranges (2003 Soil Condition Survey). In the Sleeping Child burn, Lyons (1976, 1984) found that 25 percent of the snags fell within five years and 50 percent within 10 years.

SOIL DISTURBANCE

Soil Disturbance is defined as any forest management practice that results in soil compaction, puddling, displacement, severe burning, or the loss of ground cover (FSM 2500). Previous entries in this area for timber harvest, slash disposal, and road building have created varying degrees of soil compaction, displacement, puddling, and erosion within proposed treatment units. Table 3-1 shows the soil disturbance results from the 2003 Soil Quality Condition Field Survey (Project File, SOILS-4 and SOILS-5). Interpretations are based on professional judgment. Inherent error with the field survey ranges from 4-10 percent (Carlson, unpublished survey comparisons). On a landscape or unit level analysis, approximately a third to a half of class 2 soil determinations may not actually meet the Forest Service Manual definitions of detrimental displacement or compaction.

Table 3- 1 Detrimental Soil Condition in the Lyman Planning Area

Unit	Relation to Forest Plan Standards and Guidelines
1	5% Below
2	>15% Above
3	13-15% At
4	<10% Below (Severe fire)
5	<10% Below (Severe fire)
6	Not surveyed
7	<10% Below
8	<10%

Unit	Relation to Forest Plan Standards and Guidelines
	Below
9	9% Below
10	9% Below
11	<11% Below
12	<8% Below
13	<3% Below
14	Not Surveyed
15	Not Surveyed
Area Average Based on Units Surveyed	8%

Notes: The determination of whether a unit is Above, At, or Below Standard and Guideline is based on the percentage of the unit in soil condition class 2 and 3 and review of the unit by a watershed specialist trained in soils. Forest Plan Standards and Guidelines for detrimental damage are exceeded when the total acreage of detrimentally impacted soils exceeds 15 percent (excluding landings and system roads). Planned management activities must not add to detrimental soil conditions and provide for restoration measures when and where they are appropriate (R1 Supplement No 2500-99-1, 11/12/99). The following definitions were applied:

- **Above:** The unit has greater than 15% detrimental soil conditions based on survey protocol. Soil damage is widespread with displacement exceeding 100 square feet and compaction at depths greater than 6 inches. Soil productivity is reduced as indicated by low levels of organic matter and ground cover, surface erosion, or loss of surface soil.
- **At:** The unit is between 13% and 15% detrimental soil conditions based on survey protocol. Soil damage is localized. Compaction is found primarily in the surface soil (0-6 inches depth) and areas of displacement are less than 100 square feet in aerial extent. Compaction and displacement is being ameliorated by natural processes (for example, tree root expansion, ground cover root mass expansion, organic matter, leaf, and litter layer development). Ground cover through the unit is good. In addition, it was felt that the existing skid trail system was adequate to remove timber with this entry and that mitigation measures have a high likelihood of success (prevention of additional detrimental soil disturbance).
- **Below:** The unit is below 13% detrimental soil conditions based on survey protocol. Soil damage is localized. Compaction is found in the surface soil (0-6 inches depth) and areas of displacement are small and scattered. Compaction and displacement is being ameliorated by natural processes (for example, tree root expansion, ground cover root mass expansion, organic matter, leaf, and litter layer development). Ground cover through the unit is excellent. Mitigation measures have a high likelihood of success (prevention of additional detrimental soil disturbance.

As indicated in Table 3-1, Unit 2 exceeds and Unit 3 is close to Forest Plan Standards and Guidelines. Most of the existing soil damage (compaction and displacement) was in the form of old roads, skid trails, and landings in areas that employed ground skidding and mechanical piling and burning of slash. Detrimental soil damage tends to be concentrated near roads and in the flatter portions of the units (Units 1, 2, 3, 12, 8, 11, 12, 13, 9).

Soil Compaction and displacement are related to the water holding capacity of the soil, clay content, slope and surface root mass, soil organic layer, vegetative cover, and down large wood and slash. Considering these factors and past management activities, the potential for compaction and displacement is ranked as moderate for ground-based equipment (Bitterroot National Forest Land System Inventory, McBride, in progress 2003). This rating is based on the soil texture (gravelly sandy loam), degree of past disturbance (proposed units have been entered in the past), and past use of ground-based equipment. This entry proposes winter ground-base harvest, skyline cable, or a combination (refer to Chapter 2 of this analysis for a unit description).

Soil compaction is a concern in Units 2, and portions of Units, 1, 3, 11, 12, 13, 8, and 9 (2003 Soil Condition Survey SOILS-5). Class 2 and 3 compaction was noted in the main skid trails, landings, and roads. The remaining skid trails were lightly to moderately used (Class 0 and 1) with discontinuous and slight surface compaction in the upper 2-4 inches of soil.

Past harvest in the area consists of a mix of overstory removal (HFR) harvest and commercial thinning (HTH). The units were hand felled and skidded with ground-based equipment (utilizing both rubber tired and tracked skidders). Skid trails were not predesignated and randomly occur throughout the units. Existing main skid trails are spaced approximately 50 to 75 feet apart. There is evidence that equipment often accessed each tree. Existing compaction (plated surface soils with depths 0-6 inches) is being ameliorated by the established root systems of pine grass, grasses and forbs, shrubs, and conifers unless the area was severely burned. Exposed mineral soil (except in isolated areas associated with severe fire) does not exceed 10-15 percent.

Displacement is the movement of soil from one place to another by mechanical forces such as a wheel, blade, or animal hoof. Displacement was the primary form of soil disturbance in the Lyman Units (2003 Soil Condition Survey SOILS-5). This form of disturbance was evident where machinery had sharply turned, where mechanical fuel piling occurred, or where previous harvesting had occurred during periods of wet or moist soil conditions. The potential for displacement is high given the coarse-grained soils with low cohesion (Bitterroot National Forest Land System Inventory, McBride, in progress 2003).

Puddling is a concern when units that are winter logged experience a thaw that reduces the protective barrier of snow below 2 feet or frozen ground less than 4 inches in depth, or where soils are ground based logged under wet or very moist spring, summer or fall conditions. Puddling was only observed in isolated locations in association with roads where vehicles had used the unimproved road surface during wet conditions (2003 Soil Condition Survey).

Severe Burning in the area results from the Fire of 2000 and localized burn piles created during past timber harvest operations. Sever burning related to the fires of 2000 was observed in Units 4 and 5 and isolated portions of the remaining units. In these areas, the heat of the fire has modified the surface soil properties and removed the organic layer and vegetation cover. Currently the ground cover is recovering and consists of lichens, mosses, and forbs. The effects of severe fire to existing soil conditions are discussed above under soil productivity, surface erosion and loss of organic matter. Burning effects from past timber harvest and site prep operations were observed in Units 1, 2, 3, 11, 12, and 8 (2003 Soil Condition Survey SOILS-5).

Environmental Consequences

Management activities can result in direct and indirect effects on soil resources. Direct and indirect effects may include alterations to physical, chemical, and/or biological properties. Physical properties of concern include structure, density, porosity, infiltration, permeability, water holding capacity, depth to water table, surface horizon thickness, and organic matter size, quantity, and distribution. Chemical properties include changes in nutrient cycling and availability. Biological concerns commonly include abundance, distribution, and productivity of the many plants and animals that live in and on the soil and organic detritus.

Processes known to cause the greatest adverse effects on soil physical, chemical and biological properties include soil compaction, displacement, puddling, burning, erosion, and mass wasting. Direct effects of management activities commonly include compaction, displacement, puddling, and burning. Erosion, mass wasting, and changes in water table, soil biology, organic detritus recruitment, and fertility (such as the fertilization effects of ash after a light-intensity fire) usually occur as indirect effects.

The primary concern is the impact of direct and indirect effects of management activities on soil productivity and disturbance (Forest Plan Forest Wide Management Standards 2.h.3, 5, 6, 7, 8, and 9). The magnitude of productivity loss associated with any action is influenced by the degree, extent, and duration of adverse soil conditions within and adjacent to each activity area. Degree refers to the magnitude of change in soil properties, such as an increase in bulk density or a decrease in macroporosity, and the depth to which those changes occur. Extent refers to the area affected by such changes. Duration refers to the length of time such changes may persist on or adjacent to the site.

The criteria used to determine effects on soil were the percentage of area within a proposed treatment unit and/or road/skid trail where detrimental soil disturbance occurs. The primary effects analyzed for the proposed actions are soil compaction and/or soil displacement and soil erosion.

Alternative 1 – No Action

Alternative 1 is the no action alternative. No management actions would be taken, thus there are no direct or indirect effects to the soil resource.

There would be no direct increase in detrimental soil conditions; compaction, displacement, or puddling, if this alternative were implemented. Currently Unit 2 is above Standards and Guidelines and Unit 3 is at Standards and Guidelines (Soils Existing Condition, Table 3-1). In the absence of land management, soil productivity will continue to improve (20-50 years) (Adams and Froehlick 1984). Compaction and displacement is being ameliorated through natural restoration processes, for example freeze/thaw, tree root expansion, ground cover root mass expansion, and organic matter, leaf, and litter layer development (Project File, SOILS-6, Soil Unit Restoration Plan). Effects from the Fires of 2000 will continue to diminish as ground cover and hydrologic regimes return to pre-fire conditions.

The absence of road maintenance, closure, hydrologic stabilization, and decommissioning will retard improvement in watershed cumulative effects. The sub-watersheds of Lyman and Cameron Creeks have been identified as having moderate or high risk of cumulative watershed effects related to roads (refer to the Watershed report).

Cumulative Effects

Alternative 1 would not add to cumulative soil effects. No additional detrimental soil effects would be realized since ground-based harvest and post-harvest activity would not occur. Road closure and decommissioning opportunities associated with this activity would be lost. No active soil restoration would occur.

Detrimental soil conditions are found over approximately eight percent of the surveyed acres (Table 3-2). Timber in the Lyman Planning area has been managed since WWII with a majority of harvest occurring since the mid 1970's (GIS data on historic sale activity). Evidence of compaction and displacement related to skid trails and mechanical fuel treatment is found. This existing condition is being ameliorated through natural processes including expansion of tree roots, grass and ground cover roots, and the addition of organic matter.

Soil structure and productivity in adjacent areas would continue to be altered by future, on-going, and past ground-disturbing activities. Refer to the Project File (SOILS-12) for a complete list of future, on-going, and past activities. On-going activities near or in the project area include, but are not limited to, tree planting, noxious weed spraying, grazing, timber harvest on adjacent state lands, hunting, recreation, firewood collection, and ATV use of closed roads. These actions are dispersed throughout the planning area with detrimental soil damage most evident where use is concentrated (for example dispersed recreation sites). Since these actions are on-going, detrimental soil conditions associated with these activities would not change with implementation of Alternative 1 and would persist into the future. Foreseeable future projects include continued insect infestations, ATV use of closed roads, herbicide spraying for noxious weeds, tree planting, firewood collection, and dispersed recreation. Detrimental soil conditions associated with foreseeable future activities would occur with or without implementation of Alternative 1. Since no harvest or post-harvest activities would occur with implementation of Alternative 1, no additional cumulative effects would be realized.

Regulatory Framework and Consistency

This alternative is consistent with the protection of soil resources and maintenance of long-term soil productivity in accordance with the State of Montana Memorandum of Understanding to follow Best Management Practices (BMPs), Forest Service Guidelines (FSM 2500 and R1 Supplement 2500-99-1), and the Bitterroot Forest Plan.

Alternative 2

Soil issues relating to soil productivity and disturbance will be analyzed by each proposed ground-disturbing activity. Soil productivity elements include sheet and rill erosion, gully and landslide erosion, organic matter, nutrient cycling, and large woody debris. Disturbance elements include compaction, displacement, puddling, and severe burning. The proposed treatments, all units, were designed through mitigation measures to minimize loss in soil productivity or increases in soil disturbance.

SOIL PRODUCTIVITY

Harvest Effects to Soil Productivity
It is not anticipated that the removal of select dead or dying trees, with the identified mitigations and BMPs (refer to Chapter 2), would change the existing ground cover, alter the amount of solar energy reaching the soil surface, decrease coarse woody material below that expected for the site (based on VRU and found in Table 2-4, or increase surface erosion. The basis for this conclusion is:

Soil Erosion
Soil erosion is a natural process that can be accelerated by land management activities. Soils on steep slopes with poor vegetative cover and lack of structural development are more susceptible to erosion than are soils on flatter terrain. Soil erosion would be minimized through the use of mitigations and BMPs (Chapter 2). All units would be harvested over snow or frozen conditions or with skyline cable systems. Monitoring results have shown that stringent application of Best Management Practices and mitigations (Chapter 2) protect soil resources (Maloney 1995; USDA 2001).

Units proposed for ground-based winter harvest have slopes less than 35 percent and are located on the nose and shoulders of ridges. Units 4 and 5 have a combination of coarse-grained soils and high fire severity in 2000. These soils are more conducive to erosion. Mitigations including winter ground-based harvest and skyline would reduce sediment generation and movement. Williams and Buckhouse (1993) found no runoff or sediment production from winter ground-based harvest (frozen ground and snow cover) with designated skid trails. Monitoring of winter ground-based salvage harvest on the Bitterroot National Forest has found similar results.

As discussed in the Soils Existing Condition section, the Lyman units are located on a relatively stable landscape, with the exception of Unit 5. No debris flows have occurred within ephemeral or intermittent channels either within or immediately adjacent to harvest units. The potential for debris flows and landslides is elevated due to the fires of 2000. It is not anticipated that the removal of dead or dying trees over snow or with skyline cable systems will change landscape stability. The addition of logging slash within the units would increase on-ground organic matter (based on VRU and found in Table 2-4 Management Requirements and Mitigation Measures). Tree roots, rather from standing dead trees or stumps, would provide stability for 10-15 years. The alteration of the hydrologic and soil moisture regimes in Unit 5 may alter landslide stability. This change is related to the fires of 2000, the removal of dead or dying trees will not change the fire-altered hydrology.

Groundcover

Effective Ground Cover
Vegetation protects the soil surface from raindrop impact, dissipates energy of overland flow, binds soil particles together, and dampens soil temperature extremes and daily fluxes. Studies have found that 60% effective ground cover reduced sediment movement to negligible amounts and 30% ground cover reduced erosion by ½ compared to bare soil (Robichaud, etal 2000). Harvest slash (<3inches), if scattered through the unit, may increase effective ground cover to over 80 percent (Maloney 1995, McIver and Starr 2000). In most units, effective ground cover currently averages approximately 60 percent. Units 4 and 5 are the exception where ground cover is well below 60 percent. Logging slash will add to effective ground cover although the effects of this increase would be short-term since fine logging slash would decompose quickly (Clayton 1981).

Winter Ground-Based Harvest
Groundcover on winter dispersed skid trails is not anticipated to be reduced because operations would occur over snow and operations would cease if the snowpack is broken or wet conditions are encountered (USDA 2001; Klock 1975). The potential to increase groundcover in the form of logging slash is high. Limbs and small trees (post harvest weeding) would be lopped and scattered and retained on site at the rate specified in Table 2-4 Management Requirements and Mitigation Measures.

Additional fuels would be removed from site with whole tree yarding, yarding tops, or jackpot burning. Handpiling and burning or jackpot burning of slash would reduce groundcover in a localized area under the piles. Handpiling and burning or jackpot burning is proposed in Units 9, 13 and 14. Groundcover removed with handpiling and burning or jackpot burning is anticipated to re-grow in 1-2 years. Monitoring reported in the 2001 Bitterroot Forest Plan Monitoring report found that "plant re-growth following the fire has been generally rapid …" (USDA 2001).

On main skid trails and landings, there would be a slight reduction in groundcover due to more equipment operations, even over snow. This damage would be mitigated through the use of slash mats (adds to organic matter), designating these main skid trails, suspending logs by one end, and ceasing operations if snow or frozen conditions are not met. Main skid trails would be reviewed for restoration following harvest. Restoration may include constructing water bars, creating brush sediment traps, seeding grass/forbs or planting shrubs, fertilizing, tilling or sub-soiling, or doing nothing depending on the extent and amount of groundcover reduction (refer to Soil Mitigations (Chapter 2) and Project File Soil Restoration Plan, SOILS-6). In the long-term (greater than 5 years) it is anticipated that groundcover would become re-established, with or without post-activity restoration.

<u>Winter or Summer Skyline Cable Harvest</u>
No reduction in groundcover is anticipated with winter skyline corridors because operations would occur over snow and operations would cease if the snowpack is broken or wet conditions are encountered. Groundcover in summer skyline corridors would be reduced approximately 5-10 percent (compared to winter ground-based) as a result of choker setting, cables and removing logs from the site (Clayton 1981; Klock 1975). At landings, there would be additional reduction in groundcover due to equipment operations and corridor convergence.

Loss of groundcover in the corridors and landings would be mitigated through the use of slash mats (would add organic matter), suspending logs by one end, and ceasing operations if wet conditions are encountered. Corridors and landings would be reviewed for restoration following harvest. Restoration may include constructing water bars, creating brush sediment traps, pulling material onto the corridors and landings, seeding or planting, fertilizing, tilling or sub-soiling, or doing nothing depending on the extent and amount of groundcover reduction (refer to Soil Mitigations (Chapter 2) and Project File Soil Restoration Plan, SOILS-6). In the long-term (greater than 5 years) it is anticipated that groundcover would become re-established, with or without post-activity restoration.

<u>Coarse Woody Debris (CWD)</u>
Harvest and post-harvest fuel treatments would retain downed wood at levels specified in Chapter 2, Table 2-4 Management Requirements and Mitigation Measures.

<u>Nutrient Cycling and Moisture Stress</u>
Removing dead trees is not anticipated to have long-term effects on nutrient cycling provided adequate CWD is left on site (Graham, etal 1994). CWD contributes approximately 30-40% of the organic matter in Douglas Fir Forest Types. The remaining organic mater comes from understory plants, needle cast, and other plant material (USDA Sept 2001).

Moisture stress is currently occurring in forest stands due to the fires of 2000 and coarse well-drained soil. Moisture stress will continue until ground cover and shrub or forest canopy is reestablished, reducing the amount of solar energy that hits the forest floor. Logging slash (material <4 inches in diameter) left on site in moderate amounts, will help ameliorate harsh forest floor conditions by reducing solar radiation (temperatures and wind drying) and increasing moisture retention (Maloney 1995). As the logging slash decomposed, an increase in grass, forb, and shrub production will continue to ameliorate the surface soil horizon adding organic matter (Lyons 1976, 1984; Fowler, etal 1987; Kendall unpublished 1999). This fire effect will last less than 15 years as growth of shrubs and trees occurs. Salvaging scattered dead or dying trees over snow or by skyline systems will not alter the existing solar energy reaching the forest floor, organic matter accumulation, or post fire grass, forb, shrub, or tree recovery.

Post-Harvest Treatment to Soil Productivity
Harvest generated slash would need to be treated in Units 1, 4, 6, 8, 9, 11, 12, 13, and 14. Options for treatment include whole tree yarding, yarding tops, hand piling and burning, jackpot burning, lop and scatter, or a combination of these treatments. Because existing soil concerns center around the 2000 fires, whole tree yarding, yarding tops, jackpot burning, and handpiling and burning has been prescribed for these units (Table 2-1).

Whole tree yarding and yarding tops removes much of the harvest slash from the unit and reduces the need for post-harvest treatments. To maintain site productivity, coarse woody debris would be retained on site at a rate found in Table 2-4.

Hand piling is not anticipated to have adverse effects to soil productivity. Burning of large slash piles may sterilize the underlying soil because heat is retained in the pile. This would cause localized areas of soil sterilization, reduced water infiltration, and lost groundcover. Each localized area is expected to be less than 0.1 acres in size (average pile size is 6-10 feet in diameter) and is not expected to occur on more than 1acre in Unit 9 (Table 2-1).

Jackpot burning of slash accumulations is prescribed in Units 13 and 14. These areas will be localized and would have similar effects to those described above with handpiling and burning.

Temporary Road and New Landing Construction Effects to Soil Productivity
One temporary road less than 1300 feet in length would be needed to harvest and remove material from the upper reach of Unit 5. This would result in loss of soil productivity along the length of the road. The area of impact will be approximately 0.5 acres in Unit 5.

Landings would be associated with each unit. Mitigations (Chapter 2) to restore soil productivity to the extent possible include re-contouring, providing drainage, and scarifying the surface, planting with forbs, grasses, and shrubs, and adding organic matter and compost to the road surface. Stockpiling and spreading topsoil is a recommended treatment for both temporary roads and landings if rock content does not preclude this option (Maloney 1995). To prevent erosion from the temporary road surface or landing, sufficient slash would be used on the cutslopes. For planning purposes, it is estimated that 28 landings are needed to complete Alternative 2 resulting in approximately 3-4 acres of soil disturbance scattered through the planning area.

Use of Roads for Winter Haul Effects to Soil Productivity
The continued use of system roads, even those that are well maintained, is probably the largest contributor of sediment to drainages. Studies found road related sediment to be 100-200 times the amount from undisturbed sites (McIver and Starr 2000). Winter haul has the confounding factors of potentially soft road surfaces, snowmelt running down wheel ruts, and snow berms forming on the road edge. Implementation of BMPs and the mitigation measures defined in Chapter 2 would reduce road related sediment.

Road Maintenance, Storage, and Decommissioning Effects to Soil Productivity
No new system roads would be constructed with this alternative. Road maintenance reduces road related sediments by shaping the roadbed, cleaning drainage structures, and providing a drivable surface so vehicles stay on established roads reducing impacts.

Seven roads would be put in storage with this Alternative (Chapter 2 Watershed Improvement Activities). Along three of these roads, culverts will be pulled and the drainage re-established. Similar to closing roads, placing roads in storage reduces road related sediment since the roadbeds are waterbarred and allowed to become vegetated.

Decommission does the most to improve soil productivity since roadbeds may be tilled or sub-soiled to break up compaction and improve infiltration and percolation rates. Reestablishment of water, organic matter, and nutrient cycles within the soil improves soil productivity. In road decommissioning, culverts and culvert fills are removed reducing the risk of losing the road fill during flood events. Two roads would be decommissioned under Alternative 2.

SOIL DISTURBANCE
Ground-based harvest equipment has the potential to cause detrimental soil compaction and displacement and subsequently reduce site productivity. Soil compaction increases soil density, reduces soil porosity, and consequently affects air and water and nutrient movement within the rooting zone. This may limit root development and affects the volume of soil available for plant growth. Removal of surface soils (displacement) reduces amounts of available nutrients and affects soil biological activity**.** Monitoring results have shown that stringent application of Best Management Practices and mitigations (Chapter 2) protect soil resources (Maloney 1995)

Harvest Effects to Soil Disturbance
Existing compaction and displacement exceeds Forest Plan Standards within Unit 2 and is close to standards in Unit 3 (Table 3-2)**.**

<u>**Winter Ground-Based Harvest**</u>
All ground-based harvest units (Units 1, 3, 4, 5, 8, 9, 10, 12, 13, 14) would be harvested over snow or frozen conditions (Table 2-1). Studies have found summer tractor skidding to have the highest ground disturbance (up to

36%), followed by cable skidding (up to 32%), tractor skidding over snow (approximately 9.9%), skyline (less than 3%), helicopter (0.7%) (McIver and Starr 2000). Monitoring conducted on the Bitterroot National Forest and elsewhere has found that new soil disturbance associated with winter ground-based harvest is less than 5 percent (Steve Smith personal communication; McIver and Starr 2000; Philipek 1983 and 1985; Carol Kennedy and Steve Howes personal communication; Maloney 1995; Pete Robichaud personal communication).

The above monitoring concludes that properly administrated winter logging (snow or frozen ground) causes minimal detrimental soil disturbance, generally less than 1-2 percent increase in detrimental conditions. Philipek (1983 and 1985) summarizes monitoring reports from a variety of national forests. Generally, winter logging was found to have little to no effect on the soil surface (displacement or removal of ground cover).

Skyline Harvest

Research and monitoring has found that for skyline logging (winter or summer) causes minimal detrimental soil disturbance, generally less than a 5 percent increase in detrimental conditions (Clayton 1981; Maloney 1995; McIver and Starr 2001). Soil disturbance is due to displacement and soil mixing during felling and moving trees to and within the corridor. Monitoring conducted on the Bitterroot National Forest during harvest activities within the units effected by the Fires of 2000 have found that new soil disturbance associated with winter skyline harvest is less than 1 percent (BNF BAR Monitoring Report, in progress).

Malone (1995) found skyline harvest effects to be similar to helicopter logging. Clayton (1981) presents research from Dyrness (1967 and 1972) that showed skyline logging to deeply disturb approximately five percent of the unit with Helicopter having a two percent disturbance. Corridor spacing generally averages 100-feet, which approximates 3 percent of the yarding area. Generally, skyline harvest in winter was found to have little to no effect on the soil surface (displacement or removal of groundcover). Skyline logging in the summer was found to have a minimal effect on the soil surface, primarily in the form of displacement (gouging of the soil surface) and damage to existing ground cover. Skyline logging soil disturbance may be greatest at the landing where logs are no longer suspended and corridors converge. These effects can be minimized by ensuring good suspension of the log, avoiding wet soil conditions, and placing slash in the corridor or other stabilization methods.

Summary

Units that are ground logged during winter conditions could experience a 2-5 percent increase in detrimental soil conditions. The actual percent increase in detrimental soil conditions is expected to be less than 5 percent (USDA 2001). Adherence to mitigation measures (Chapter 2) is integral to the validity of this assumption.

Units that are skylined logged could also experience a 2-5 percent increase in detrimental soil conditions (USDA 2001). The actual percent increase in detrimental soil conditions is expected to be less than 3 percent for summer skyline operations and less than 1 percent for winter skyline harvest (USDA 2001). Adherence to mitigation measures (Chapter 2) is integral to the validity of this assumption.

Increases in detrimental soil conditions related to harvest is expected to be less than 4% over existing condition, a change from 8% to 12%.

Post-Harvest Treatment and Prescribed Fire Effects to Soil Disturbance

Harvest generated slash would be treated in Units 1, 4, 6, 8, 9, 11, 12, 13, and 14. Options for treatment include whole tree yarding, yarding tops, jackpot burning, and hand piling and pile burning. The effects of slash treatment on soil disturbance are similar to those discussed above under Soil Productivity.

Temporary Road and Landing Construction to Soil Disturbance

Soil compaction and displacement would occur during temporary road and landing construction. The effects would be similar to those discussed above under Soil Productivity.

Road Maintenance, Closure, and Decommissioning Effects to Soil Disturbance

Effects of road maintenance, closure, and decommissioning would be the same as described for soil productivity.

Soil Restoration Plan

Preliminary soil restoration plans have been developed for all harvest units (Project File, Soil-6). For Unit 2, which is above Standard and Guidelines and Unit 3, which is close to the standards, the cumulative detrimental soil effect following project implementation and restoration would not exceed existing conditions (Forest Service Manual Direction, Region 1 Supplement 2500-99-1, effective 11/99). A soil scientist or watershed specialist bases this restoration plan on pre-project field surveys. The restoration plan would need to be reviewed after harvest and fuel treatments in Units 2 and 3. As stated in the mitigations, skid trails, landings, and temporary roads used with this entry would be restored.

Under Alternative 2, approximately 4 acres would be improved through active restoration with the obliteration of 1.4 miles of road. An additional 16 miles of road closures and storage will further reduce road related sediment. From pre-activity soil surveys:

- Natural restoration would be prescribed for both Units 2 and 3 because damage is localized and limited to flat areas adjacent to roads (Project File – Soil Restoration Table SR1 SOILS-6). Compaction is not dense or continuous enough for successful sub-soiling. Displacement is the primary form of existing damage. No active erosion was found and ground cover is well established.
- Tilling or sub-soiling in conjunction with seeding and shrub or tree planting would be used on temporary roads and landings and system roads proposed for closure (Project File – Soil Restoration Table SR2 SOILS-6).

Cumulative Watershed Effects

Table 3- 2 Alternative 2 - Soil Effects Summary

	Existing Condition (% Detrimental)	**Alternative 2**
Harvest Effects on detrimental soil conditions	8%	12%
Temporary Roads and Landings effects		1%
Cumulative Increase in Detrimental soil conditions		13%
Active and Passive Restoration including landings, temp roads, system road decommissioning and closures		1-2%

Ground-based harvest activities limited to snow or frozen conditions may increase detrimental soil conditions by 0-3 percent. Skyline corridors may increase detrimental soil conditions or erosion by 1-3 percent. Mitigation measures (Chapter 2) have been developed to reduce the likelihood of increases in detrimental soil conditions. In addition, soil condition on the landscape would be improved with road decommissioning.

Soil structure and productivity in adjacent areas would continue to be altered by future, on-going, and past activities (refer to the Lyman Salvage Sale Project File for a complete list of future, on-going, and past activities). On-going projects near or in the Lyman area include, but are not limited to, tree planting, noxious weed spraying, grazing, timber harvest on adjacent state lands, hunting, recreation, firewood collection, and ATV use. These actions are dispersed throughout the planning area with detrimental soil damage most evident where use is concentrated (for example dispersed recreation sites). Since these actions are on going, detrimental soil conditions associated with these activities would not change with implementation of Alternative 2 and would persist into the future.

Foreseeable future projects include continued insect infestations, ATV use of closed roads, herbicide spraying for noxious weeds, tree planting, firewood collection, and dispersed recreation. As with on-going actions, soil effects from these activities are dispersed across the landscape with detrimental soil damage most evident where use is concentrated. Detrimental soil conditions associated with these activities would occur with or without the implementation of Alternative 2.
Due to the dispersed nature of on-going and future actions and the limited effects expected from the Lyman Salvage sale, cumulative soil productivity and disturbance effects are not expected.

Regulatory Framework and Consistency

This alternative is consistent with the protection of soil resources and maintenance of long-term soil productivity in accordance with the State of Montana Memorandum of Understanding to follow Best Management Practices (BMPs), Forest Service Guidelines (FSM 2500 and R1 Supplement 2500-99-1), and the Bitterroot Forest Plan (Project File Regulatory Framework for Soils, SOILS-9).

Units that are below Forest Plan Standards and Guidelines for soils have mitigations in place (refer to Chapter 2 for mitigations) that would result in minimal increase in detrimental soil conditions. Cumulative detrimental soil effects following project implementation and restoration would not exceed Forest Plan Standards and Guidelines.

Units that are at or above Forest Plan Standards and Guidelines for soils (Units 2 and 3) have mitigations and soil restoration plans (Project File Soil Restoration Plan SOILS-6) in place that would result in no measurable increase in detrimental soil conditions. Cumulative detrimental soil effects from project implementation and restoration would not exceed current conditions and restoration should move the units and landscape toward a net improvement in soil quality (Forest Service Manual Direct Region 1 Supplement 2500-99-1, effective 11/99).

For all units, implementation of mitigations through sale administration is integral to the above statements of consistency with the Bitterroot Forest Plan and Forest Service Policy. Any increase in detrimental soil conditions is expected to be limited in aerial extent (found in localized areas only) and size (generally in small, isolated locations).

Soil technical support has been provided for all project alternatives through the assessment of existing condition and environmental consequences for soil resources included in this document, consistent with the Forest Plan and Forest Service Guidelines. Retention of coarse woody debris exceeds that required under the Forest Plan and is consistent with research (Graham, etal 1994).

No fuel or harvest treatments are being proposed on identified wetland areas, consistent with Executive Order 11990.

Alternative 3

SOIL PRODUCTIVITY AND DISTURBANCE

Harvest and Post-Harvest Effects to Soil Productivity and Disturbance

Harvest effects for Alternative 3 would be less than Alternative 2 because fewer acres would be harvested. Approximately 143 fewer acres would be winter ground-based harvested and 48 fewer acres would be winter or summer skylined with Alternative 3. Harvest and post-harvest effects are described under Alternative 2. Under Alternative 3, Unit 5 is dropped which will reduce any management related effects to landslide stability on the south facing slope of the unit.

Temporary Road and Landing Construction to Soil Productivity and Disturbance

No temporary roads would be constructed with Alternative 3. Since Unit 5 has been dropped from this alternative the 1300 feet of temporary road would not be constructed.

Effects to soil productivity and disturbance from landing construction and use would be similar to Alternative 2 although fewer landing would be needed since Units 5, 7, 8, and 10 have been dropped and acres reduced in Units 4, and 13. Approximately 28 landings are needed under Alternative 2 with an estimated 16 needed for Alternative 3.

Road Maintenance, Closure, and Decommissioning Effects to Soil Productivity and Disturbance

No new system roads would be constructed with this alternative. The road closure and decommissioning package is the same for both Alternatives 2 and 3. The effects of maintaining, closing, or decommissioning roads would be similar to those described under Alternative 2.

Soil Restoration Plans

Preliminary soil restoration plans have been developed for all harvest units (Project File, Soil-6). For Unit 2, which is above Standard and Guidelines and Unit 3, which is close to the standards, the cumulative detrimental soil effect following project implementation and restoration would not exceed existing conditions (Forest Service Manual Direction, Region 1 Supplement 2500-99-1, effective 11/99). A soil scientist or watershed specialist bases this restoration plan on pre-project field surveys. The restoration plan would need to be reviewed after harvest and fuel treatments in Units 2 and 3. As stated in the mitigations, skid trails, landings, and temporary roads used with this entry would be restored. Refer to the discussion under Alternative 2.

Cumulative Watershed Effects

Table 3- 3 Alternatives - Soil Effects Summary

	Existing Condition (% Detrimental)	Alternative 2	Alternative 3
Harvest Effects on detrimental soil conditions	8%	12%	10.5%
Temporary Roads and Landings effects		1%	0.5%
Cumulative Increase in Detrimental soil conditions		13%	11%
Active and Passive Restoration including landings, temp roads, system road decommissioning and closures		1-2%	1-2%

Alternative 3 would increase detrimental soil conditions approximately three (3) percent over existing conditions. This effect is less than Alternative 2. Cumulative watershed effects are similar to those described under Alternative 2.

Regulatory Framework and Consistency

This alternative is consistent with the protection of soil resources and maintenance of long-term soil productivity in accordance with the State of Montana Memorandum of Understanding to follow Best Management Practices (BMPs), Forest Service Guidelines (FSM 2500 and R1 Supplement 2500-99-1), and the Bitterroot Forest Plan (Project File Regulatory Framework for Soils, SOILS-9).

Under Alternative 3, Unit 5 is dropped from consideration reducing any management related slope stability concerns.

Units that are below Forest Plan Standards and Guidelines for soils have mitigations in place (refer to Chapter 2 for mitigations) that would result in minimal increase in detrimental soil conditions. Cumulative detrimental soil effects following project implementation and restoration would not exceed Forest Plan Standards and Guidelines.

Units that are at or above Forest Plan Standards and Guidelines for soils (Units 2 and 3) have mitigations and soil restoration plans (Project File SOILS-6) in place that would result in no measurable increase in detrimental soil conditions. Cumulative detrimental soil effects from project implementation and restoration would not exceed current conditions and restoration should move the units and landscape toward a net improvement in soil quality (Forest Service Manual Direct Region 1 Supplement 2500-99-1, effective 11/99).

For all units, implementation of mitigations through sale administration is integral to the above statements of consistency with the Bitterroot Forest Plan and Forest Service Policy. Any increase in detrimental soil conditions is expected to be limited in aerial extent (found in localized areas only) and size (generally in small, isolated locations).

Soil technical support has been provided for all project alternatives through the assessment of existing condition and environmental consequences for soil resources included in this document, consistent with the Forest Plan and Forest Service Guidelines. Retention of coarse woody debris exceeds that required under the Forest Plan and is consistent with research (Graham, etal 1994).

No fuel or harvest treatments are being proposed on identified wetland areas, consistent with Executive Order 11990.

WATERSHED/WETLANDS

Introduction

The watershed analysis focuses on the current watershed condition and the effects of the implementation of any of the proposed alternatives on the water resource. It includes evaluation of sediment sources, water yields and past activities that have contributed to existing conditions.

Regulatory Framework

Forest Plan Standards

The Bitterroot National Forest Land Management Plan describes Forest-wide standards that apply to the water resource. This standard direct management to maintain soil productivity, water quality and water quantity (p. II-3).

Forest-wide Management Objectives state that riparian areas will be managed to prevent adverse effects on channel stability and fish habitat (p. II-6).

Soil and water conservation practices (also called BMPs) will be part of the project design to ensure soil and water resource protection. A copy of the Bitterroot BMPs is located in the Project File.

The Forest Plan also directs management to actively reduce sediment from existing roads. This includes such actions as graveling in sediment contributing areas, stabilizing or vegetating cut and fill slopes, straw bales or slash filter windrows to filter sediment in sediment contributing areas and cross drains into vegetated filters away from streams.

Montana Streamside Management Zone Act

The Montana Streamside Management Zone Act (SMZ) establishes a management zone along streams and wetlands. The SMZ is intended to provide a buffer between the stream and forest activities to help keep sediment from the upland entering streams. This act prohibits several forest practices within the SMZ; activities on the Bitterroot National Forest must comply with the SMZ law. The State required SMZ is narrower than the buffer required by INFISH, which amended the Forest Plan in 1995.

Section 208 of the 1972 amendments to the Federal Water Pollution Control Act (Public Law 92-500) specifically mandates identification and control of non-point source pollution resulting from silvicultural activities.

Clean Water Act

Section 303(d) directs states to list water quality impaired streams (WQLS) and develop total maximum daily loads (TMDL) to control the non-point source pollutant. In Montana, agencies are instructed to use the 1996 303(d) list of Water Quality Impaired Streams even though the 2000 list has been approved. The analysis area for this project is located within HUC 0506, Cameron Creek. It is within the Bitterroot Headwaters area that is being evaluated by the State currently for TMDL development will result in the cooperative development of a recovery plan that will recommend the types of activities that lead to reduced pollution sources in the long term on public and private lands within the Headwaters area. The streams within the analysis area provide input to the East Fork of the Bitterroot River that is on the 1996 303(d) list.

Best Management Practices (ARM 16.20.603) are the foundation of water quality standards for the State of Montana. The Forest Service has agreed in a Memorandum of Understanding with the State of Montana to apply BMPs. The Bitterroot National Forest has further refined State BMPs to address specific concerns on BNF lands. Many BMPs are applied directly as mitigation and project design. Implementation and effectiveness monitoring for BMPs would be routinely conducted by contract administrators and during other implementation and annual monitoring events.

Audits of BMP application and effectiveness conducted by the State (Ethridge, 2002) indicate that on Federal lands. BMPs were properly applied 89% of the time and that these were 89% effective in preventing degradation of water quality. The report showed that BMPs were applied 100% in the streamside management zone, and were 100% effective. Monitoring of best management practices following BAR implementation shows that BMPs within harvest units are being applied and are effective. The most concerns stemmed from haul roads during spring breakup (USDA Forest Service, 2002a, unpublished report).

Area of Analysis

The analysis area for Lyman Salvage Sale is the Cameron (HUC 0504) and Guide watersheds and includes discussion on downstream effects in the East Fork of the Bitterroot River. Guide is included and will be discussed to a limited degree because the haul route for Lyman would be on FDR 311 and this closely parallels Guide Creek for 2.4 miles. No other activities from this project are in the Guide Watershed. Guide is within Middle East Fork, HUC 0503 that includes several other small face streams that are tributary to the East Fork of the Bitterroot River.

Effects Analysis Methods

Existing conditions will be evaluated using field visits, stream surveys and modeling efforts. Some of the information developed during the 2001 Bitterroot Burned Area Recovery (BAR) analysis regarding estimated sediment and water yields will be included.

The effects of roads and proposed road work will be evaluated by estimating the amount of sediment currently being produced and how that may change from the proposed actions. For road-produced sediment, the methodology used will be that developed by Paul Callahan in his road sediment inventory on Upper Lolo Creek (Land and Water Consulting, 2001, p. 4-5). In this inventory/analysis field measurements determined the amount of sediment delivered to streams from roads. Although there are minor differences between Upper Lolo Creek roads and those found in this analysis area, conditions are similar, including type of road and gross parent material. This analysis method was also used to determine road sediment in the Burned Area Recovery project (FEIS, 2001). The estimates of sediment associated with this analysis are not absolutes, they are estimates that can be used to provide and indicator of the effect of the proposed actions.

For vegetation management effects, Disturbed WEPP (Elliot, 2000) will be used to estimate sediment contributed to streams from proposed harvest and fuels treatments. Disturbed WEPP was used to estimate the amount of sediment currently being contributed to streams from the proposed treatment areas and included post fire ground cover conditions. These areas were then modeled to estimate the increased amount of sediment that could be contributed given additional ground disturbance associated with timber harvest and yarding activities. Model results can be used to indicate the magnitude of change that is likely to occur following implementation. *These estimates are for comparison only; they do not represent actual measurements of sediment production*. Professional judgment (based on on-site visits and monitoring during and following implementation of other projects) will be used to estimate the effects of these estimated sediment changes on water quality and stream channel conditions.

In this proposed project, mostly dead and dying trees would be harvested. The harvest of dead and dying trees as proposed in this project is not likely to result in increases in water yield because these trees are transpiring very little and if not dead now would be within a short time period. Removal of dead trees can alter snow distribution sooner than if they were left on site and allowed to fall over a period of several years but the difference in water yield increases between harvest and no harvest is very small. This is supported by the modeling effort that was done for Cameron Creek watershed in the BAR. Water yield modeling in Cameron Creek watershed during analysis estimated water yields might increase 0.1% from the harvest of up to 2973 acres (Land and Water, 2001). These estimates indicate that removal of dead and/or dying trees influenced water yield to only a small degree when a large area (2973 acres) was to be harvested. With the small amount proposed to occur with the Lyman project, the increase would be even less.

The project proposes to harvest a limited amount of live trees to improve stand conditions. The effect of this harvest on water yields will be evaluated using an equivalent clearcut methodology (ECA) that is described in Hydrology Part II. This method equates partial cutting to some equal amount of clearcut and the effect of that upon water yields.

Pre- and post-fire stream survey data will also be used for the analysis of existing conditions where available. Sediment source inventories conducted on road prior to the fires can be used to indicate likely problem areas.

Stream surveys followed the protocols described in the Bitterroot Watershed Evaluation Process (Decker, 1993) and included channel geometry measurements, Rosgen (1996) stream type classification, substrate composition and productivity and channel stability measurements. Stream surveys in Cameron Creek conducted prior as well as following the 2000 fires will be used to help determine existing condition. Sites are established on Guide Creek, North Fork Cameron, and Cameron above the 311 Road.

Rosgen (1996) describes the method of classifying streams into groups of similar form and function. Measuring stream widths, depths, gradients, sinuosity, entrenchment and substrate determine the stream type. Classifying a stream allows for comparison or measured parameters between streams of the same class.

The Tarswell Substrate Ratio (TSR) is a measure of productivity of the stream. The survey looks at substrate composition and assigns a value based upon the dominant substrate: sand, clean gravels/cobbles/boulders, or moss. Sand is the least productive, moss the most productive. Sediment deposition in the substrate of the stream reduces fish spawning areas and insect productivity. The larger the Tarswell Substrate Ratio the more productive the stream. (USDA Forest Service, 1993)

The Channel Stability Ratio (CSR) evaluates the stability of the stream channel. It considers stream bank composition, vegetation and slope, valley bottom shape and slope, and substrate conditions. Lower numbers indicate a more stable stream reach.

The percent fines in the substrate are an indication of the amount of deposition in the substrate and is determined by a variation on the Wolman Pebble Count (Wolman, 1954). This count measures the size of 100 pieces of sand, gravel, cobbles or boulders from the substrate of the stream and includes a variety of habitat types rather than focusing on only one habitat such as the riffle. It provides a “picture” of the stream substrate composition.

Existing Condition

This analysis area consists mostly of lands within the Cameron Creek watershed, (HUC) 0504 and consists of 31,467 acres of private, State and National Forest lands. The fires of 2000 affected a large portion of this watershed; sixty percent of the watershed was affected by high and moderate severity fire and another five percent by low severity fire. The lower portion of the haul route on National Forest Land is located in the lower elevations of Guide Creek. This watershed received mostly low severity fire with pockets of high severity in a few small areas.

Past Activities

Both Guide and Cameron Creeks are considered high risk in the Bitterroot Sensitive Watershed Analysis (Decker, 1991) because of the miles of road and the number of stream crossings. In Cameron Creek, there are approximately 260 miles of road and although none of these parallel streams, there are many stream crossings. Of this, over thirty miles are located in the Lyman Salvage analysis area. In Guide Creek the 311 Road is located in the valley beside the stream for 2.4 miles. Review of some of the roads in the analysis area during a watershed inventory in 1996 and 2001, found that small rills and ruts were common on the road surfaces throughout the analysis area and although there were no large obvious sediment sources there was minor erosion from many of the numerous road fills and stream crossings in the watershed.

Table 3-4 lists road information for the watersheds in the analysis area and includes roads on State, Federal and private land.

Table 3- 4 Road and Crossing Densities

Watershed	Road Density All Ownerships (mi/square mi)	Road Density BNF Only (mi/square mi)	Number of Road Crossings
Cameron	5.4	2.9	557
Lyman	6.2	8.1	53

Roads are the primary contributor of sediment to streams. In the BAR analysis conducted by Land and Water (2001), sediment produced by roads in Cameron Creek was estimated at approximately 138 tons. Roads located along streams (as is the case of Guide Creek) often have direct lines of transport between sediment sources and streams; where roads cross streams, there are potential contributing points (King and Gonsior, 1981; Logan and Clinch, 1991, p. 6, Burroughs, 1990).

In the BAR project, the decision was made to gravel stream crossings, and upgrade the roads to improve the drainage system and reduce watershed impacts (BAR 2-20 and 2-11). This work has not been completed to date because of funding but it is still planned and would be implemented when funding is available (it is not possible to predict when funding would be available for these projects). When the BAR improvements are complete, sediment would be reduced by 14% or eighteen tons in Cameron Creek (Land and Water, 2001).

Wildfire can also be a source of sediment and changes to stream channel conditions. Cameron had a large percentage of land burned by high and moderate severity fire and has been the greatest source of change within the watershed in the recent past. Forest soils are very prone to erosion immediately following a fire but recover quickly as vegetation recovers. Studies have shown that by the fourth year, fire associated erosion is negligible (Elliot and Robichaud, 2001). Review of burned units in the Cameron Creek watershed by project hydrologist indicates that 80-90 percent of the ground now has vegetation growing upon it.

Table 3- 5 Acres Burned During Fires of 2000

Watershed	Total Area (acres)	Amount Burned at High and Moderate Severity
Cameron	31,467	18,924
Lyman	4,181	3,389

BAR-related harvest has also recently occurred in the Cameron watershed. Since February of 2002, approximately 3,600 acres in Cameron watershed has been harvested. Monitoring during implementation of these units has shown that little ground disturbance occurred and there has been no observation of sediment from harvest related ground disturbance crossing RHCA boundaries or entering streams (PF-WAT-3). Based upon monitoring, the sediment that was estimated to result from yarding activities in the FEIS is greater than what has actually occurred and no eroded sediment resulting from harvest has entered into or crossed RHCAs (PF-WAT-3, WAT-4, WAT-35)

The majority of State lands within Cameron Creek were harvested the winter of 2000-2001. In the Monitoring Report of the Sula State Forest Fire Mitigation, Salvage and Recovery Project (2002) the result of harvest on watershed conditions is minimal. The State applied a 50’ no harvest buffer adjacent to streams. To summarize their monitoring report:

- BMPs were implemented and were effective in controlling erosion.
- No departures from standard BMPs were observed.
- Buffers were effective in maintaining adequate levels of shade and large woody debris recruitment to fish bearing streams.
- Limited erosion has taken place as a result of fires and subsequent rainstorms.
- Stream temperatures increased following the fires.
- Measured streamflows were below averages resulting in low sediment and nutrient values.

Table 3-6 displays sediment estimates associated with post-fire sediment production and harvest in the BAR FEIS.

Table 3- 6 Sediment Yield Estimates (Land and Water, 2001)

Watershed	Post-Fire Sediment Estimates	Increases Estimated as Result of Post Fire Harvest (all ownerships)
Cameron	7,999 tons	+92 tons
Middle East Fork (Guide)	1,694 tons	+19 tons

Cameron Creek is currently very near the water yield threshold. It is commonly thought by forest hydrologists that a water yield increase of greater than 12% can lead to channel instability and water yields in Cameron Creek are currently estimated at approximately 11.1% (Land and Water, 2001). In Cameron equivalent clearcut acres have been estimated at 19,203 acres. Because of this high level of ECA and the model estimates of current water yield, there is a risk that water yields are at or close to levels where channel stability may be affected.

Wetlands
Wetlands, as defined in the Corps of Engineers Wetlands Delineation Manual (1987), are "those areas that are inundated or saturated by surface water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." According to this source, an area is considered wetland if it has wetland hydrology (high water table, inundated or frequently flooded), hydric soils (soils that are saturated in the upper layers, flooded or ponded for significant lengths of time), and a predominance of hydrophytic vegetation (plants adapted to water or wet soils). All three criteria must be met. Wetlands in the analysis area were determined using infrared aerial photos and field visits. Wetland locations have been mapped and are on file in the project records.

Wetlands were classified using "Classification of Wetlands and Deepwater Habitats of the United States", 1979. In this classification system, wetlands are differentiated by form, substrate and vegetation.

Wetlands throughout the analysis area have been affected by fire and are recovering from that disturbance. Where fire has affected wetlands, the vegetation has been rejuvenated and soil moisture levels have increases because of nearby vegetation mortality. Where fire has burned through wetlands, vegetation is respouting and is 2-3 feet tall after the 2002 growing season There are isolated locations where wetlands have experienced degradation such as at road crossings where culverts and filling for roadbeds have eliminated function; where historic overuse of livestock has occurred and where past logging practices have disturbed vegetation and soils.

Wetlands are present throughout the analysis area with the larger wetlands being in the lower elevations of Cameron Creek and tributaries because it has more gentle land slope and wide valley bottoms. In the wider, flat landscapes, wetlands are larger, and high ground water tables are present over wide areas. Field visits have shown that wetlands on National Forest lands also occur in higher elevation gentle swales and are typified by seepy, hummocky areas with standing water without associated defined stream channels.

The Riverine subsystem of wetland is found near streams with relatively high velocity flows. These consist of mainly those associated with linear stream features and are narrow forested wetlands. Riverine wetlands within the analysis area consist of those associated with both perennial and intermittent streams. Analysis area-wide, these are the most common wetland type.

Palustrine (or spring associated) wetlands are present in the wider valleys such as Cameron. The Palustrine subsystem includes wetlands dominated by trees, persistent emergents and mosses in non-saltwater systems and includes swamps, bogs, fens and marshes. Smaller areas of Palustrine wetlands are typified by willow, aspen or alder brush and often have (or had and will have following vegetation recovery) an overstory spruce forest.

Stream Channel Conditions
The majority of streams within the analysis area are steep A4 streams as described by Rosgen. Because of granitic geology, streambanks are composed of gravelly/sandy banks with a large percentage of sands in the substrate. These types of streams are characterized by narrow floodplains, fairly straight streams with high gradients (greater than 4% water surface slopes). Vegetation, both deciduous and coniferous was present prior to the fires along streams but in much of the Cameron Creek watershed where activities are proposed high and moderate severity fire have burned portions of the riparian vegetation. Although a percentage of streams were burned over during the Fires of 2000, the shrubby rooted plants (alder, willow) remain viable and are sprouting.

Peak flow yields do increase after fire because of tree mortality, change in shading and the heating of surfaces when the forest is removed by fires (Farnes, 2000). The mortality of trees removes many "pumps" from the system and this water is available for runoff. Debris flows are a dramatic source of high flows that can occur following high intensity storm events. In Cameron Creek, there have been no known debris flows, nor are there visible effects to stream channels from increased flows like there has been in other parts of the burn area. Because peak flows do increase following fires (Campbell and Morris, 1988), there will be some changes in stream channels.

Lyman Creek has the highest total road densities (6.2 miles/square mile for all ownerships, 8.1 for National Forest only) of any of the Cameron Creek subwatersheds. There are 53 stream crossings in the Lyman watershed. The large numbers of road/stream crossings increase the number of potential sediment source areas. This level of road development in the watershed coupled with the amount of moderate and high severity fire in the Lyman watershed has greatly contributed to the amount of fine sediments in the channel (see Fisheries section) as well as to other aspects of channel conditions. Because of the sediment produced by roads and fire, it is likely that streams are slightly wider and shallower than unmanaged or burned reference reaches and have greater percentages of unstable banks.

A survey reach located above the 311 Road on Cameron Creek indicates that channel conditions are similar to reference streams. Cameron Creek below the 311 Road has been most affected by development. It is likely that the lower reaches of Cameron have greater percentages of fines and lower stability because of numerous sediment sources. Another survey located on North Fork Cameron above the 311 Road indicates that channel conditions on North Fork Cameron are similar to reference conditions.

Guide Creek stream surveys indicate there are a larger percentage of fine sediments in the substrate than is present in reference reaches. Channel stability is very low with portions of the channel incised with erodible stream banks. Road 311 in the Guide Creek drainage would be hauled on in both action alternatives.

There are no known domestic spring or water developments on National Forest Land in Guide or Cameron Creek. . There may be some downstream on private land but there are no records of this on the Forest. The primary use from surface water in Lyman and Cameron Creek is flood irrigation on French Basin ranches

Environmental Consequences

The Disturbed WEPP model (Elliot et.al, 2000) was used to estimate sediment production and delivery to streams from proposed activities. This model uses storm events (from a specified period of time) and vegetative cover (among other parameters) to estimate possible erosion and likelihood of that sediment being contributed to streams any given year. This likelihood of sediment being contributed to streams is dependant upon the occurrence of a storm with an intensity and/or duration to initiate erosion and transport eroded sediment to streams. The probability calculated by WEPP is the likelihood of a storm of sufficient intensity and duration occurring any given year that is capable of initiating and transporting sediment to a stream any given year (PF-WAT-24).

WEPP was used to estimate current sediment production for each unit as well as sediment that may be produced following the proposed activities. *These estimates are for comparison purposes only; they are not absolute measurements of sediment.* The estimates provide an indicator of the magnitude of change from current conditions that could be expected following implementation, not an actual, measurable increase. Skyline yarded units were assumed to occur in the summer; whereas ground based harvest would occur only with winter conditions present. The cover reduction for winter yarding was based upon Burned Area Recovery Project monitoring of winter ground based harvest units where ground disturbance (cover reduction) was 5% or less during the winters of 2001 and 2002 (Project File-WAT-4).

Table 3- 7 Percent Cover Reduction by Yarding System

Yarding System Used	Percent Cover Reduction Estimated
Tractor Winter	5%
Skyline	5%

<u>Effects Common to All Action Alternatives</u>

Sediment yields were estimated for winter ground based yarding systems. WEPP estimated that there would be no increase from yarding activities where 2000 burn severity was low or was unburned. However, in units burned by moderate to high severity fire, the proposed activities did result in an estimated increase in sediment contributed to stream channels. The sediment estimates provided by the model are based upon storms that might occur over a thirty year time period. Probability of sediment contribution from proposed activities ranged from 3% for units located in low or unburned areas up to 17% in moderate and severely burned stands. Even though the WEPP model estimated an increase in sediment contribution, it is not expected to actually enter stream channels because of the presence of buffers between activity areas and streams or wetlands, the monitoring results of post-fire harvest, and the low level of probability or likelihood of eroded sediment being transported to streams. Monitoring indicates that very little ground disturbance occurred during the winter harvest of 2001 and 2002 and where it did, eroded materials did not move offsite and into the RHCA buffer (Project File-WAT-3, WAT-4, WAT-14, WAT-15). Monitoring of winter yarding on the Buck Pilot timber sale on the Wallowa Whitman National Forest in 2002 (PF-WAT-7) has shown that yarding with winter conditions resulted in very limited change in levels of soil compaction and it is expected that results following the Lyman Salvage project would be similar.

None of the action alternatives would increase sediment to a measurable degree. Table 3-8 displays the result of WEPP model estimates. Although the model estimates increases in sediment contributions, monitoring indicates this type of activity implemented in similar conditions does not result in sediment crossing buffers. *Model estimates are for comparison purposes only; they are not absolute measurements of sediment.* These estimates provide an indicator of the magnitude of change from current conditions that could be expected following implementation, not an actual, measurable increase.

Streamside and wetland buffers where equipment and timber harvest would be excluded would maintain vegetation and soils conditions along wetlands and stream channels. This would reduce the risk of damage to wetland areas adjacent to streams from compaction or soil disturbance. Buffer boundaries would be flagged prior to implementation.

In all action alternatives, some reduction in fuels would occur through harvest and/or post-harvest fuel reduction. The amount of this varies for each unit, and the severity of a future wildfire is expected to decrease to some degree from the existing level because of the change in fuel levels. How much of an actual decrease is dependant upon yearly climate cycles, fuel moisture conditions and weather. The proposed treatment units are small patches of unburned, slightly burned or heavily burned forest surrounded by lands burned during 2000. Harvest in the proposed units is not likely to affect the risk of large fires in the Cameron watersheds. However it could affect fire severity within the treatment areas themselves. Within the treatment units there would be fewer fuels, less soil heating during a fire, lower fire severity, and less risk of hydrophobic soils. High severity fire results in hydrophobic soils (Elliot, 2000) when during a hot fire, the pores within the soil are sealed because of extreme heating of the soil (DeBano, 1998). From a hydrologic as well as sediment standpoint, hydrophobic soils are probably THE largest effect of high severity fire. By reducing the risk of hydrophobic soils, the risk of erosion and sedimentation in streams in decreased considerably. This being the case, the action alternatives would reduce the risk of hydrophobic soils within the treatment units (and the risk of erosion and stream sedimentation following fire), however, it is not likely to affect severity or hydrophobic risk in surrounding untreated areas.

The haul route for this project would be the 311 Road, about three miles of this road parallels Guide Creek. There is some risk that lack of maintenance or poor maintenance could allow runoff to enter Guide Creek especially during winter break-up or other wet periods. Increased traffic also causes depressions in the road bed, which can channelize water flow on the road surface. This increased flow can lead to greater sediment delivery to Guide Creek. Proper snowplowing methods and acceptable periods of hauling during winter or wet weather are incorporated in the timber sale contract and the BMPs. Monitoring during the 2002-2003 winter hauling period (PF-WAT-14) indicates that good contract administration does occur and that risk of sediment contribution from roads is minimized.

With action alternatives, 1.4 miles of road would be decommissioned and 12.6 miles would be closed year long, (culverts removed) and stored for future use. The surface of these roads would be decompacted, seeded and mulched). This would reduce road density only to a small degree on paper (because 12.6 miles would be stored) but would remove seven culverts from Lyman Creek and decompact and revegetate 14 miles of road. During the decommissioning and storage activity, there would be opportunity for erosion and sediment contribution to streams especially at crossings (PF-WAT-36, refer also to Fisheries Report). However, monitoring of the road storage work that occurred in Robbins Gulch in 2002 indicates that topography, slash, and mulch, limit sediment transport (PF-WAT-10). Decompaction and vegetation on proposed roads in Cameron would allow for revegetation, infiltration, less sediment production and less runoff from approximately 24 acres of land. Calculations indicate that sediment would be reduced by about 1/3 from current levels following recovery.

Allowing yearlong motorized access on the first 1-6 miles of Road 13304 would not have adverse watershed effects because the road segment is on a flat grade, has a stable surface, and has no perennial stream crossings. Use of this road is expected to be low.

The removal of seven culverts would contribute the largest proportion of the total sediment produced by proposed activities. Removal-generated sediment would continue until bare slopes surrounding the culvert removal site recover. Based upon the amount of ground disturbed and its' potential for erosion, short-term increases are estimated to be about one ton per culvert (Project File-WAT-13), about seven tons contributed to channels from the culvert removal. Mitigation (erosion control mat, seeding and slash placement) would reduce this amount and sedimentation would decrease to near zero after vegetation was established. Culvert removal would restore floodplain function, eliminate the need for maintenance, and eliminate the risk of culvert failure at these locations.

There would be no known effects to domestic water uses downstream from the project. If domestic water uses exist on private property downstream, any sediment or water yield increases from the project would not be likely to adversely affect them because of distance (at least two miles downstream) and the anticipated low levels of sediment or water yield increase.

Alternative 1 (No Action)

Direct and Indirect Effects

With the no action alternative, there would be no additional ground disturbance. The units that were burned at high or moderate severity would continue to recover on the current trend without any setback in surface disturbance that might occur as a result of this proposal. Erosion and sediment contributed to streams that increased following the fires are currently on a decreasing trend. This recovering trend would continue, as there would be no additional ground disturbance. The WEPP model was used to estimate the amount of sediment being contributed to streams from the land area within the proposed units. This estimate is listed under “Alternative 1, Existing” in Table 3-8. Land areas that were unburned or burned at low severity were estimated by WEPP to be contributing no sediment to streams at this time. Research has shown than fire-related sediment declines (DeBano, 1998) and after about three years returns to pre-fire levels (USFS, 1981) without additional disturbance that trend would continue. Within areas that were burned at low severity, or were unburned, it is estimated that sediment contributed to streams would remain at the current low levels. Personal observation (field review) of burned areas (high, moderate and low severity burns) indicates that vegetation is recovering and that fire related sediment yields are no longer a concern in the vast majority of the burn, including the Lyman Project area.

There would be no increased traffic or increased risk of sediment contribution to Guide Creek from the 311 Road.

Alternative 1 would provide no opportunity to store or decommission roads. None of the seven culverts would be removed, there would be no increase in sediment from their removal or from nearby disturbed ground. There would be no additional sediment above that currently being contributed to streams from existing sediment sources. There would be no improvement in channel or wetland function from the streams improved ability to access floodplains at the location of the seven culverts.

Alternative 2

Direct and Indirect Effects

Alternative 2 proposes to treat the largest number of acres and a greater proportion of area would be yarded using ground-based systems. This increases the risk of sediment production and contribution to streams, however, monitoring has shown that sediment has not crossed buffers or entered streams on recent Bitterroot National Forest timber harvest projects. Units in Alternative 2 include areas that were subject to high severity fire in 2000 as well as areas of past ground based yarding. Within these areas affected by high and moderate severity fire, there is somewhat less ground cover, limited amounts of accumulated duff (soil protection) and so a greater risk of ground-based equipment causing further ground cover reduction. The larger number of acres and greater amount of ground based yarding results in larger estimates of sediment (Project File-WAT-6) than in Alternative 3 (refer to Table 3-8) being contributed to the streams within the analysis area.

Because of the location of proposed units, approximately 47% of the model estimated sediment produced by the proposed harvest would be contributed to streams in the Lyman watershed. Sediment contributions to Lyman Creek are not likely to be transported in Cameron Creek or the East Fork because Schoolmarm Lake would trap and hold the majority of sediment produced. The remainders of the units are located in Cameron Creek and sediment from those units would be contributed to Cameron Creek. However, monitoring of ground based BAR timber sale units did show that due to good sale administration, project design and good winter conditions, little ground disturbance occurred and no sediment associated with harvest crossed streamside buffers (Project File-WAT-14). Alternative 2 has a greater amount of ground-based harvest in areas where the risk of ground disturbance is greater than does Alternative 3 and so sediment estimates are higher. Although the model estimated sediment contributions from harvest, BAR monitoring (on a similar project) has shown that no sediment is being contributed to streams and it is expected that results from this alternative would be similar (Project File-WAT-35).

Streams that may be affected by estimated increases in sediment yields are already stressed from fire-related and road related sediment. Because Lyman has many sediment sources, the increases associated with this alternative increase the risk that stream channel changes in Lyman Creek may occur. In Cameron Creek, although the WEPP model estimated sediment contributions to occur, this stream is more stable and has higher streamflows and so the risk of channel changes is lower. Again, monitoring shows that consistent sale administration and appropriate project design (Project File-WAT-14. WAT-15, WAT-35) can protect water quality. Burned Area Recovery monitoring indicates this is occurring and it is assumed that continued sale administration will protect water quality in the Lyman Project.

The road decommissioning and storage and culvert removal would occur as described previously in the "Effects Common…" section. It is estimated that sediment produced by the roadwork would be about the same as estimated to be produced by harvest activities in Alternative 2. These sediment levels would decrease over time as vegetation became established and disturbed soils stabilized.

Alternative 2 would have the greatest risk of the two action alternatives of increasing sediment contributions from hauling because there would be a greater number of loads hauled. Mitigation, project design, BMP application and monitoring as described in Chapter 2 would occur during hauling to reduce the risk of sediment input to the stream. Monitoring of hauling operations in 2003 indicates that proper sale administration, snowplowing operations and mitigation is effective in protecting streams water quality (Project File-WAT-14)

Alternative 3

Direct and Indirect Effects

In Alternative 3, there is a reduction in the total number of acres treated compared to Alternative 2 and the units dropped are located in areas of high severity burn, include mostly ground based areas that were located in Lyman Creek, the most sensitive sub-watershed of Cameron Creek. Because these sensitive areas are not included, WEPP sediment estimates are considerably lower than those for Alternative 2. All of the estimated sediment would be contributed to Cameron Creek rather than split between Cameron and Lyman watersheds (Project File-WAT-6).

The amount of sediment that is estimated to be contributed to Cameron Creek from harvest activities is relatively small and not likely to be measurable in the stream or affect channel conditions to a measurable degree. The risk of channel changes from the sediment inputs associated with harvest activities is very low.

Monitoring of ground based yarding in BAR timber sale units showed that very little ground disturbance occurred during winter yarding and no sediment from what ground disturbance did occur moved off-site or crossed into delineated stream buffers (RHCAs) (Unit Logs 4/19, 6/13, 1/30/03). This further supports the claim that estimated small increases (from the WEPP modeling) wouldn't cause changes in channel conditions.

The road decommissioning and storage and culvert removal would occur as described previously in the "Effects Common…" section. The sediment estimated to be produced from roadwork would be greater than that estimated to occur from proposed harvest activities of Alternative 3 and occur immediately following implementation.

Table 3- 8 WEPP Estimate of Sediment Contributed to Stream Channels from Proposed Unit Areas

Alternative 1, Existing Condition Sediment Estimate is 8.92 tons	Estimate of Sediment Winter Tractor, Summer Skyline Yarding
Increases from Alternative 2	Increase of 8.73 tons
Increases from Alternative 3	Increase of 1.14 tons

Alternative 3 would have a lower risk of increasing sediment contributed to streams from hauling activities because there would be a fewer number of log loads hauled. Mitigation, project design, BMP application and monitoring as described in Chapter 2 would occur during hauling to reduce the risk of sediment input to the stream. Monitoring of hauling operations in 2003 indicates that proper sale administration, snowplowing operations and mitigation is effective in protecting streams water quality (PF-WAT-14).

Cumulative Effects

Past, Ongoing and Reasonably Foreseeable Activities
The following is a list of activities where there is very low risk to contributing to cumulative effects when combined with the Lyman Salvage Sale Project. This is because their potential for sediment production or water yield increase is low due to 1) the location where activities might take place in relation to the analysis area or streams, 2) the size of the activity, or 3) the mitigation that would be applied during implementation.

- Personal Use Firewood and Christmas Tree Cutting
- Hunting, Fishing, Dispersed Recreation
- Schoolmarm Lake
- Mushroom and Special Products Harvest
- Waugh Gulch Burned Interface Demonstration Project
- Fish stocking by MFWP
- Private pond construction and fish stocking
- Forest Service facilities construction or reconstruction
- Forest Trail Construction and Maintenance
- Facilities Maintenance
- Prescribed Fire

Activities that may contribute to cumulative effects, even if to a small degree:

- <u>Past Forest Service Timber Sales and Associated Road Construction, Reconstruction and Maintenance.</u> Timber harvest and road construction has occurred on most of the Cameron Creek watershed. Vegetation management activities older than three years are likely contributing no sediment (USFS, 1981) but roads continue to a chronic source of sediment, especially at stream crossings.
- <u>BAR Related Activities have Occurred Throughout the Analysis Area.</u> Sediment actually produced by these activities is actually much lower than that estimated during BAR analysis. Monitoring indicates that BAR related harvest has resulted in only a small amount of ground disturbance (Unit logs 3/26, 6/13, 7/9, 11/5, 11/13/02).
- <u>Robbins Gulch Timber Sales are located Outside of the Analysis Area.</u> One drains into the East Fork downstream of the Lyman Salvage project area. Based upon Unit Logs to date (PF-WAT-10) little to sediment has been contributed to streams from sale implementation or road obliteration. The effect of the Lyman Salvage is expected to be small and would not contribute to sediment effects from these sales in the Lower East Fork.
- <u>Guide Timber Sale.</u> Located in Guide as well as Jennings Camp Watershed. Unit Logs (1/30, 2/3, 2/5, 2/13/03) indicate that little ground disturbance has occurred. Effects are not likely to be measurable in downstream locations.
- <u>Road Densities Indicate Multiple Sediment Sources and Road Locations Near Streams.</u> Stream surveys indicate that these influence channel conditions. Maintenance on forest roads would be ongoing and include blading, culvert inlet and ditch cleaning. This activity does disturb the road surface and can increase erosion from the road for a short time period. However the benefit of restoring drainage and reducing future erosion offsets the short-term increase. Sediment sources would be reduced with both action alternatives by putting into storage and removing culverts from 12.6 miles of road. Another 1.4 miles of road would be decommissioned. Fire related road repairs have been ongoing since 2001 and included blading, inlet cleaning and culvert replacement. Of these three activities the culvert replacement likely resulted in the most sedimentation during construction and immediately following as vegetation recovered.
- <u>Bark Beetle Outbreaks</u>. It is likely that this will continue throughout the forest and this analysis area leading to more areas with increased water yields (Potts, 1984). It is also likely that the forest would recommend

harvest of at least some of these areas. This would not affect water yields to a measurable degree because the trees would already be dead and evapotranspiration ceased but the method of harvest could result in some ground disturbance and changes in sediment yields. The magnitude of this affect would depend upon the location of the areas in respect to streams, the type of yarding system used and the mitigation required. Use of mitigation and the application of BMPs can limit the ground disturbance of this future harvest and the potential for erosion. Complete analysis would occur wherever this harvest was proposed and considered in NEPA decision.

- <u>Artificial Reforestation</u>. Planting trees in clearcuts decreases the amount of time it takes for a cleared area to become hydrologically recovered by several years. Hydrologically recovered is defined as vegetative recovery to a level that approximates a mature stand in use of soil moisture, and snow distribution, typically this takes about 30 years in this area. In the analysis area, approximately 6,800 acres of plantations had fire burn through them in 2000, as a result of the BAR project, almost 5,000 acres of these will be planted.
- <u>Roads on State and Private Lands</u>. Construction of roads on State lands requires mitigation and road standards similar to those on National Forest lands and so the risk of sediment production is lower than on private land where roadwork is not regulated. As part of the State restoration plan in Cameron Creek, over eight miles of roads were stabilized and closed following the fires and state harvest. Road construction, reclamation and maintenance can cause increased sediment contributed to streams and reduction in channel conditions during construction activities and until vegetation is established and soils stabilize, especially when adjacent to stream channels (Luce and Black, 1999). However there is a long-term benefit to watershed health from decompacting and revegetating soils.
- <u>Private Land and State Timber Sales.</u> Harvest depending upon yarding system and the amount of trees removed can affect sediment and water yields. On State lands the application of BMPs is required, on private land they are optional. The location of the harvest in relation to streams, the application of BMPs, the slope of the land and yarding system influence ground disturbance, erosion and sediment potential. On State land, monitoring of fire related harvest required the use of a streamside buffer that was effective in maintaining shade, woody debris recruitment potential and filtering sediment (DNRC, 2000). On private land, it is estimated that up to 467 acres could be harvested following the fires in Cameron Creek. Some of this has occurred, most of it within a year of the fire. If harvest within the Cameron Creek watershed was similar to what occurred on below Sula Peak (this is visible from the East Fork Highway and the French Basin Road), effects to watershed health were probably minimal. My evaluation of these effects is based upon distance viewing, as I haven't gotten landowner permission to walk through private lands.
- <u>Noxious Weeds Treatment</u>. Herbicide treatment of noxious weeds has occurred along roads in the Cameron Drainage. These avoid application on wetland sites and adjacent to stream channels. Applied correctly, re risk of herbicides having a lingering effect on water quality is low, as dosages are very small (Information Ventures, 1998). This project wouldn't change the frequency or intensity of these roadside treatments. In the 2003 Noxious Weeds Record of Decision about 2,500 acres are proposed for treatment in the Cameron Creek-mostly in areas burned in 2000, and 3,100 acres in the Middle East Fork HUC, of which Guide is included. Weed treatments in Guide are would take place on winter range. Reduction in noxious weeds would likely lead to long term reductions in sediment by promoting native vegetation and restoring surface protection to reduce erosion potential. Monitoring effects of spray projects on Mormon Ridge and Sawmill RNA suggest that risk to water resources is minimal when applied properly (USDA Forest Service, 2003). The implementation of the Lyman Salvage would not affect the areas proposed to be treated with the Noxious Weeds EIS nor it's effects.
- <u>Farming, Ranching and Subdivision on Private Land.</u> Some land in the Cameron watershed that was historically 'farmed' is now used for pasture or home site/resort development, most is still used for ranching purposes. Except for an increased number of roads associated with homes and resorts, the effects of farming or ranching verses the resort/resort development are likely similar. A few landowners who are maintaining their properties as ranches currently hold the private land in the analysis area; however additional subdivision could occur at the landowners' discretion.
- <u>Fire Suppression.</u> Fire suppression resulted in more dense stands throughout the area. This has helped lead to a greater amount of ground fuels and probably contributed to the size and severity of the 2000 fires. It is likely that fire suppression will continue, especially along wildland urban interface areas located throughout the East Fork. This may reduce the spread of small fires given the right weather conditions and may lead to increased fuels in these areas if they aren't reduced by some other method.

- 2000 Fire Effects. The Fires of 2000 fire burned a large portion of the Cameron and Rye Creek watersheds and portions of the Guide watershed to lesser degree. The summer of 2003 was the third growing season following the fires and research has shown that after three years, sediment produced by fires is approaching pre-fire levels (USDA, 1981). The water yield effects of the fires will continue until vegetation recovers. It is expected that higher flows will cause channels to adapt and enlarge to carry these larger flows. For about ten years following the fires, there are likely to be channel changes from increases in water yields (Gresswell, 1999).
- 2000 Fires-Suppression and Rehabilitation Effects. Hand and dozer fireline was constructed in the Cameron and Rye Creek watersheds, no dozer-line was constructed within streamside management zones. All of this was rehabilitated following active fire suppression. Monitoring conducted in 2002 on firelines on the Sula District by the Zone Fisheries Biologist (USDA, 2001) indicates that firelines were rehabilitated and are well stocked with grass. Erosion off these sites is minimal, isolated, and not decreasing channel conditions.
- 2000 Fires- Completed BAER Projects. Almost 1,300 acres of log erosion barriers were installed in the Cameron Creek watershed following the fires in an attempt to reduce the risk of overland flow. On the hillslope behind the Sula Fire Station, several debris flows have occurred in previously dry draws. This draw flows water during runoff events transporting and depositing sediment on the East Fork Road. 255 acres of seeding occurred during BAER rehabilitation efforts on National Forest Lands above the Sula Fire Station in an effort to improve vegetation recovery on a dry sandy slope and reduce the erosion risk. Additional seeding occurred on State and private lands. Seeding on National Forest lands was not very effective but any success would improve conditions by stabilizing soil to some degree and reducing the risk of erosion.
- 2000 Fires and other Wildfire Effects. Wildfires have occurred and will continue to occur within the analysis area. Both Cameron and Guide Creek had some of the Sleeping Child fire burn within their watershed boundaries. These areas are currently supporting stands of pole sized and larger trees. Other small, less impactive wildfires have burned in isolated locations in these two watersheds. 2000 fires burned a large percentage of the Cameron Creek watershed but only portions of the Guide watershed (refer to discussion earlier in this report). Wildfire has the potential to increase water yield (tree mortality and hydrophobic soils) and sediment yield (reduction of ground cover and overland flow events). The effects of sediment from wildfire locally are relatively short-lived because vegetative recovery reduced the amount of erosion that takes place. Water yield increases from wildfire can last for many years because tree mortality eliminates evapotranspiration allowing more moisture to be available for runoff. Stream channels adjust and adapt to changes in both through the fire and recovery cycles.
- Ditches, Diversions, and Irrigation Dewatering Ditch Bills. Irrigation withdrawals occur in the analysis area at the lower elevations and on private land. This activity reduces flows in streams below diversions, can affect stream temperature, lead to decreased channel size and affect the ability of the channel to carry flood flows. Construction of Schoolmarm Lake located on Lyman Creek created a reservoir in the late 1970's, this limits flow both of water and sediment in Lyman Creek below this point considerably except during peak flows. It is likely that any sediment resulting from upstream activities in Lyman Creek will be deposited in Schoolmarm Lake and not affect downstream uses. The amount of sediment estimated to be produced would be a small amount not likely to be noticeable in the reservoir. Activity related to water withdrawals is expected to continue indefinitely. Sediment produced during culvert removal will be deposited downstream within a couple hundred feet of where the pipe is removed. This will be transported downstream during peak flows the following spring (and in Lyman Creek be deposited in Schoolmarm Lake) and is unlikely to affect downstream irrigation. In Cameron Creek the amount of sediment estimated to be produced is likely to be deposited in low gradient areas or transported through the system and would not affect irrigation in the Cameron Creek watershed.
- East Fork and Highway 93 Construction, Reconstruction and Maintenance. The East Fork Road parallels a section of Cameron Creek for a couple hundred feet, straightening an otherwise meandering stream. Along the East Fork several river meanders have cut-off, the river straightened and floodplain access was restricted on several reaches. Reconstruction of Highway 93 between Sula and Warm Springs resulting in pulses of sediment during construction activities but now the highway is set back from the river and sediment input from winter sanding operations is much lower than prior to reconstruction. Effects from highways will continue although at a lower level because of the improvements made to Highway 93 in 2002.
- Grazing on National Forest Land. Shirley Mountain Allotment utilizes land on the East Side of Cameron Creek and in Guide Creek, while Sula Peak is on the West Side. Livestock use can (and at times does) result in streambank trampling, compaction of soils in livestock favored areas where herding efforts are not

effective. Most of the Sula Peak use is located in the upper elevations above streams and use occurs in the headwater areas and on ridgetops. Shirley Mountain use occurs mostly in Guide and Jennings Camp (outside of analysis area) but also in Cameron. This activity will continue. The Lyman salvage project will not increase livestock use along streams above current levels because of the no cut buffers that will be marked along streams. Livestock use in the area will continue along the same trends as currently exist. Implemented as planned, this project would not alter livestock use or contribute to additional cumulative effects.

- Grazing on Private Land. This activity is common on private land in lower Cameron Creek. Several working ranches utilize grasslands, open areas and streamside areas for livestock. Livestock use can (and at times does) result in stream bank trampling, compaction of soils in livestock favored areas where herding efforts are not effective. Some of the lower elevation stream reaches have been fenced to exclude livestock and/or limit use along streams. Livestock use likely has some effects on stream bank stability and vegetative conditions on private land but the extent of that effect is not known. This proposed project would not change use on private land or change access along streams because of the buffer.
- Elk Point II and Little Bull Timber Sales. These projects are part of the Burned Area Recovery Project and have been completed to date. Monitoring of ground conditions following harvest has shown the disturbance in most areas was less than 5% (PF-WAT-14) and that sediment produced by harvest activities did not cross buffer areas or enter streams or wetlands (PF-WAT-3 and WAT-4). The sales only removed dead or dying trees and so didn't contribute to water yield increases.
- Off Highway Vehicle EIS/ROD (USDA, USDI 2001). This analysis resulted in the restriction of off road vehicles to existing roads and trails. This represents an improvement in watershed conditions because is limits the development of new user made trails and the formation of new erosion sources.
- Middle East Fork EAWS Planning. This entails analysis of existing conditions of the landscape in the area between Tolan and Meadow on both sides of the river. It is plausible that a project would follow the analysis that would involve timber harvest, fuel reduction and watershed improvements but that depends upon conditions and recommendations. Because the effects from the Lyman proposal would be small, there would be the risk of additional cumulative effect would also be small. Additional NEPA analysis would accompany any proposed actions resulting from the Middle East Fork EAWS and the effects of the Lyman project would be considered in the analysis.

Alternative 1

Cumulative Effects

No additional activities are proposed with this alternative. There would be no opportunity for additional road storage and obliteration. There would be no additive effects that could be combined with the effects from past, ongoing or reasonably foreseeable activities. Watershed conditions would continue on the same trend as currently exists.

Alternative 2

Cumulative Effects

The implementation of this alternative is estimated to result in a larger amount (compared to Alternative 3) of sediment contributed to stream channels, due to the fact that some of the more impactive portions of the project would take place on lands were burned at high severity in 2000 and have not yet developed a layer of duff and dense vegetation. In the Cameron Creek watershed, high road densities are likely contributing sediment at many of the stream crossings. This, combined with the effects from grazing, sediment from roads, fire caused sediment and the other sediment producing activities described in the cumulative effects list above has a greater risk than Alternative 3 of causing channel changes.

The road storage and decommissioning would reduce the number of road crossings by seven and improve vegetation and infiltration on about 40 acres of previously compacted soils (road-beds). In the long term, sediment yields in the project area would be lower from the road work.

Cameron Creek water yields are currently estimated at 11.1%, very near to the water yield threshold. The harvest of live trees on up to 20 acres moves the watershed closer to but not to or above this threshold. This harvest would increase the amount of equivalent clearcut area by 0.03 of a percentage point. The increase in the amount equivalent clearcut area by 7-12 acres should not result in increases to the levels that affect channel changes.

Alternative 3

Cumulative Effects

The implementation of this activity is estimated to cause a small increase in sediment contributed to stream channels. It is not likely that this would be measurable or cause measurable effects in stream channels. The risk of channel changes from increases in sediment yield would be less than the risk associated with Alternative 2.

Combined with activities in the cumulative effects list above that could increase sediment within the analysis area (timber sales on private land, bark beetle infestations, other fuel reduction projects) the increases combined with those from this alternative are not likely to lead to changes in stream conditions within the analysis area or downstream.

The road storage and decommissioning would reduce the number of road crossings by seven and improve vegetation and infiltration on 20 acres of previously compacted soils. In the long term, sediment yields would be lower from this activity.

Cameron Creek water yields are currently estimated at 11.1%, very near to the water yield threshold. The sanitation harvest of live trees on up to 20 acres moves the watershed closer to but not to or above this threshold. This harvest would increase the amount of equivalent clearcut area by 0.03 of a percentage point. The increase in the amount equivalent clearcut area by 7-12 acres should not result in increases to the levels that affect channel changes.

Consistency with the Bitterroot Forest Plan and Other Regulatory Direction

Forest Plan Standards

The Forest Plan directs management to maintain water quality and quantity (Forest Plan p. II-3). The proposals associated with this project do this by keeping sediment production low, over snow yarding methods that also limit ground cover reduction (Project File-WAT-16 and WAT-4) and limiting water yield increases to a very small amount.

The Forest Plan directs reduction of sediment from existing roads. Alternatives 2 and 3 follow this direction by providing for drainage improvements on haul roads within the analysis area and storing or decommissioning roads.

Montana Streamside Management Zone Act

Forest wide management objectives state that riparian areas will be managed to prevent adverse effects on channel stability (Forest Plan p. II-6). All alternatives follow this direction by limiting potential water and sediment yield increases. This is accomplished by limiting the amount of area treated (limits water yield increase and area of potential ground disturbance), enforcing the Montana Streamside Management Zone Act (excluding equipment and broadcast burning within the SMZ).

Best Management Practices

The application of Best Management Practices or BMPs (ARM 16.20.603) is the foundation of water quality standards for Montana. The application of BMPs in all harvest and road construction activities would meet the State of Montana requirement for the maintenance of beneficial uses. Department of Natural Resources Forestry BMP Audit Reports for 2000 indicate that Forest Service timber sale projects are applying BMPs and that they are effective in maintaining water quality (Ethridge and Heffernan, 2000). Monitoring of selected units of Burned Area Timber Sales implemented to date by Bitterroot National Forest Hydrologists also indicates that BMPs are applied on Bitterroot National Forest timber sales, this monitoring is continuing on the Forest (Project File-WAT-18). Mitigation beyond that required by BMPs is described in Chapter 2. A copy of BMPs is located in the Project File (Project File-WAT-12).

Clean Water Act

Lyman and Cameron Creeks are tributary to the East Fork and as such contribute water and sediment (both natural and human-caused) to the East Fork. Lyman Creek enters Cameron Creek at Milepost 8.6. Cameron Creek enters the East Fork above Camp Creek at Mile Post 13.1. The project area is at least 10 river miles from the East Fork and there are several sections of State and private land between the National Forest boundary and the confluence of Cameron Creek with the East Fork. The East Fork of the Bitterroot River is on the State of Montana's list of impaired streams due to a threatened cold-water fishery. Montana Department of Environmental Quality is currently studying the East

Fork for development of TMDLs and a watershed restoration plan. The plan is scheduled to be completed late in 2003.

Table 3- 9 303(d) Listing Status

Stream	Listing Status	Beneficial Use	Impairment	Source	Notes
Lyman Creek	Not listed	N/A	N/A	N/A	Tributary to Cameron Creek, at Milepost 8.6
Cameron Creek	Not listed	N/A	N/A	N/A	Tributary to EF Bitterroot River, at Milepost 13.1
EF Bitterroot River	Listed TMDL being completed, expected completion date winter 2004.	Cold Water Fisheries	Flow alteration Habitat alteration Siltation	Agriculture Irrigated crop production Rangeland	Cold Water fisheries (rainbow trout, brown trout and cutthroat trout) are not thought to be impaired in the East Fork Bitterroot (Jakober personal communication). Native fisheries are not thought to be impaired from the East Fork Bitterroot River from the Headwaters to Meadow Creek (Jakober, personal communication. Also refer to the fisheries write-up).

Flow Alteration. The increase in equivalent clearcut area from the proposed project is estimated to be about 0.03 of a percentage point (7-12 acres). It is not likely that this would be measurable in an increase in flows in Cameron Creek or the East Fork.

Schoolmarm Lake, located on private land on Lyman Creek is a 25 acre reservoir that pools water and traps sediment from Lyman Creek. This reservoir likely reduces peak flows in Lyman Creek below the dam and Cameron Creek below Lyman Creek.

There are six ditches that divert water from the East Fork between Tolan Creek and Camp Creek (near the confluence with Cameron Creek). This proposed project would not have any effect on the water rights and the use of them near the project area.

Habitat Alteration. The project is located more than ten river miles from the East Fork. Existing roads would be used and units are some distance from streams (buffers of 50-300 feet, depending on fish presence or absence). There are also several sections of private and State land between National Forest, between where the units are located and the river. Because of these considerations, the project has very low risk of effecting habitat in the main stem of the East Fork.

Sediment. In Cameron Creek, the tributary to the East Fork where this project is located, this analysis has estimated that sediment yields would increase for Alternative 2 by 8.7 tons and in Alternative 3 by 1.1 tons for the harvest of timber (PF-WAT-6) and overall sediment levels reduced by about 30 percent by the road storage and decommissioning (obliteration) in the long term (PF-WAT-36). Another improvement for watershed, wetlands, and fisheries habitat is the removal of seven culverts. This would allow the channel to access wetlands, eliminate the risk of culvert failure and remove blockage to fish habitat. This project would not remove timber or allow equipment in RHCA buffers and would not alter livestock access to riparian areas, except where culverts were removed.

Table 3- 10 Summary Documentation for Ground Disturbing Projects in 303(d) Listed Watersheds

Documentation Required	Comments
1. Describe the water quality limited streams and why they are on the 303d list.	Refer to Table 3-9
2. Present evidence if they should not be listed, if appropriate.	Refer to Table 3-9 The Bitterroot NF Fish Biologist does not consider cold water fisheries, the designated beneficial use, to be at risk in the Bitterroot River from the Headwaters to Meadow Creek (Jakober, personal communication).
3. Identify the TMDL completion date and discuss any involvement the Forest has in assisting with the completion.	The TMDLs are currently on schedule to be completed late in 2003. The Bitterroot NF is an active participant in the Bitterroot Headwater TMDL
4. State clearly that we are in compliance with appropriate water quality laws, state measures used to comply, highlight any measures taken that go beyond what is required (distribution of disturbances through time or restoration measures to be included in the decision are examples not directly addressed by BMPs), and discuss the effectiveness of measures.	Montana State Code (75-5-702, Annotated 2001) provision 10 c) states, " new or expanded nonpoint source activities affecting a listed water body may commence and continue provided those activities are conducted in accordance with reasonable land, soil, and water conservation practices;" • Bitterroot National Forest BMPs will be applied and their effectiveness monitored by Timber Sale Administrators during harvest activities or hauling or Contracting Officers Representatives (for road storage and obliteration) during project implementation. • INFISH and the SMZ law would be implemented and are included in the Bitterroot BMPs. • A complete list of BMPs is available in the Project File. • Mitigation as displayed in Chapter 2 will also help reduce impacts of the proposal to water and fisheries resources. • BMP monitoring associated with Burned Area Recovery (Project File-WAT-35) indicate BMPs were incorporated in timber sale contracts as well as being applied during road storage and obliteration projects (PF-WAT-10) and have been effecting in preventing or limiting watershed effects and the intent of BMPs were met (Draft Watershed 2002 Monitoring Report). Ground disturbance was observed to be minimal, sediment was not being actively transported to streams, and following harvest, the units are well vegetated (Project File-WAT-37) during BAR implementation was hauling on roads during wet periods and spring breakup; additional mitigation and close monitoring in winter 2002-2003 made improvements in this area (Project File-WAT-3, WAT-14, WAT-15, WAT-31). Similar mitigation is planned for this project. • State-wide audits completed by DNRC indicates that in 2002, BMPs on National Forest Lands were applied 89% of the time, they were 89% effective in reducing effects to water quality, the SMZ Law was applied 100% of the time, and the SMZ was 100% effective in preventing sediment input (Project File-WAT-36). • Alternatives 2 and 3 include a road package that would store 12.6 miles of road and decommission 1.4miles. This project would remove seven culverts from the stream system in Cameron Creek and improve infiltration and vegetation on about 24 acres of land. The construction activities associated with the proposed road work is estimated to increase erosion and sedimentation because of ground disturbance and removal of culverts. On the benefit side, long-term sediment would decrease by about 30% (Project File-WAT-36) in the analysis area, the risk of culvert failure at seven sites would be

Documentation Required	Comments
	eliminated, riparian areas at these sites would not be fragmented by culverts (likely undersized) and fish connectivity would be improved. These roads are located within watersheds tributary to the East Fork (Lyman and Cameron), are over eight miles from the confluence with the East Fork and so the risk of sediment reaching the river would be minimal but also, it is not likely that there would be noticeable improvements in the East Fork from these improvements either.
5. State that beneficial uses are being protected and if there is likely improvement, state how much.	The Montana Department of Environmental Quality has given all National Forest waters its B-1 classification (ARM 16.20.604). Beneficial uses will be protected through the application of BMPs (refer to discussion in above block) and project design (winter ground based, skyline yarding, use of INFISH buffers). • The amount of sediment predicted to be delivered to streams by this project should not further impair water quality. The WEPP model was used to estimate that about 8.9 tons of sediment was currently being contributed to streams from proposed activity areas. This would be increased by 8.7 tons for Alternative 2 and only 1.1 tons for Alternative 3. An additional amount of sediment could be contributed from culvert removal (about 1 ton/culvert). Monitoring of similar recent projects indicates that proper project design and contract administration reduced sediment contributions well below that estimated with computer models (Project File-WAT-3, WAT-4, WAT-10, WAT-14, WAT-15). • INFISH buffers (refer to Mitigation in Chapter 2) will be marked and no activities will be allowed inside the buffers. • Monitoring of similar projects (Project File-WAT-PF-WAT-3, WAT-4, WAT-WAT-14, WAT-15) indicates that the application of buffers, winter and skyline yarding are effective in preventing sediment from being transported to streams (add reference). • An improvement project is incorporated into the action alternatives that would improve watershed conditions and reduce sediment on about 24 acres of roaded area.
6. Clearly state what water quality monitoring will be done or is being done and how adaptive management will be conducted if required.	Past Monitoring • Burned Area Recovery Project Monitoring has indicated that the implementation of salvage harvest on recently burned lands can be done and still protect water quality (Project File-WAT-3, WAT-4, WAT-10, WAT-14, WAT-31). Because this project is similar to those monitored with the BAR EIS and the area has had three years for vegetation recovery since the 2000 fires, it is expected that effects would be similar to less impactive. Project Monitoring • Refer to Appendix B
7. Be sure peer reviewed references are used whenever possible.	Please refer to the DRAFT 2002 Burned Area Recovery Monitoring Report (Project File-WAT-18) and the Watershed and Fisheries Reports in this EA.

The Montana Department of Environmental Quality was sent information on this proposal during scoping and no reply was received. They will be sent a copy of this EA and their comments requested.

FISHERIES

Introduction
The fisheries analysis focuses on the current condition and effects on bull trout (*Salvelinus confluentus*) and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) populations, which are the two native trout species in the Bitterroot River drainage. The analysis also considers impacts to other native and non-native fish species.

Regulatory Framework
The regulations and standards that govern the fisheries resource on the Bitterroot National Forest are contained in several documents. The primary document is the 1987 Bitterroot Forest Plan (USDA Forest Service, 1987) as amended by the 1995 Inland Native Fish Strategy (INFISH, USDA Forest Service, 1995). Other supplementary documents include:

- The Montana Streamside Management Zone Law (Montana DNRC, 1994)
- The Endangered Species Act (bull trout listed as Threatened in 1998)
- The Bull Trout Biological Opinion (USDI Fish and Wildlife Service, 1998)
- The Draft Bull Trout Recovery Plan (USDI Fish and Wildlife Service, 2002)
- The State of Montana Bull Trout Restoration Plan (Montana Bull Trout Restoration Team, 2000)
- The Westslope Cutthroat Trout Conservation Agreement (Montana DFWP, 1999)

For more detailed information on these documents and their specific standards and recommendations, please consult the Project File (Project File- FISH-2).

Area of Analysis
The analysis area for fisheries includes Cameron Creek, Lyman Creek, Schoolmarm Lake, Guide Creek, and the East Fork of the Bitterroot River downstream of Guide Creek. Cameron Creek and an unnamed tributary to Lyman Creek called the “North Fork of Lyman Creek” are the fish-bearing streams that drain the proposed timber harvest area. The lower mile of Guide Creek is a fish-bearing reach that is paralleled by FDR 311, the main haul road. The named channel of Lyman Creek (the South Fork) does not support fish on National Forest land. With the exception of the North Fork of Lyman Creek, none of the unnamed intermittent and perennial streams in the project area contain fish. The non fish-bearing streams provide seasonal habitat for other aquatic species, such as reptiles, amphibians, and invertebrates.

Effects Analysis Methods
Healthy bull trout and westslope cutthroat trout populations require clean substrates, cold water, complex hiding cover (i.e. pools and large woody debris), and populations that are connected to each other. Collectively, these key habitat characteristics have been coined “the four C’s” (Montana Bull Trout Restoration Team, 2000). In this project, the criteria used to evaluate effects to fisheries include:

- Sedimentation
- Water temperature
- Water yield increases
- Woody debris recruitment
- Migration barriers

These evaluation criteria are closely related to “the four C’s”. Each of the alternatives has been analyzed for its potential to affect these criteria. A detailed description of these evaluation criteria is available in the project file (Project File- FISH-2, pgs 4-6).

Existing Condition

Data Collection
Electroshocking surveys were conducted in Cameron Creek (summers 1999-2003), the North Fork of Lyman Creek (summers 1999 and 2003), and Guide Creek (summers 1999 and 2003) to determine fish species presence, distribution, and relative abundance. Post-2000 fire electroshocking surveys have been conducted in Cameron Creek (2001-2003), the North Fork of Lyman Creek (2003), and Guide Creek (2003).

Fish habitat surveys were conducted in Cameron Creek (summers 1999-2003), the North Fork of Lyman Creek (summers 1999 and 2003), and Guide Creek (summers 1999-2003) to assess existing conditions, sediment levels, and status of the INFISH Riparian Management Objectives. Post-2000 fire habitat surveys have been conducted in Cameron Creek (2001-2003), the North Fork of Lyman Creek (2003), and Guide Creek (2002-2003).

Stream temperatures were monitored in Cameron Creek, Guide Creek, and the North Fork of Lyman Creek in 1999, 2000, 2001, 2002, and 2003 using continuously-recording thermographs. Water temperatures have also been monitored at three sites in the East Fork of the Bitterroot River (near Conner, near Tolan Creek, and in the headwaters at the East Fork trailhead).

Fish Populations

In Cameron Creek, westslope cutthroat trout and brook trout (*Salvelinus fontinalis*) are the two most prevalent fish species. The relative mix of these two species changes with elevation. On the floor of French Basin, brook trout are abundant and westslope cutthroat trout are uncommon. In the middle reaches on state land, both species are common and occur in relatively equal densities. In the headwaters on Forest Service land, westslope cutthroat trout outnumber brook trout by about a 2 to 1 ratio. The total length of habitat occupied by westslope cutthroat trout in Cameron Creek is about 15 miles. Overall, westslope cutthroat trout densities in the upper half of Cameron Creek appear to be relatively healthy, while those in the lower half of Cameron Creek are reduced from historic levels. Other fish species that occur in Cameron Creek are longnose sucker (*Catostomus catostomus*), and mountain whitefish (*Prosopium williamsoni*). Both species are confined to the floor of French Basin.

Figure 3- 1 Cameron Creek

The fires of 2000 burned about 35% of Cameron Creek, mostly at moderate severity with embedded patches of higher severity (USDA Forest Service, 2001a, pg 3-276). There have been no significant mudslides in the Cameron Creek drainage since the fires. Post-fire electroshocking surveys did not detect a fish kill in the burned portions of Cameron Creek upstream of FDR 311 (USDA Forest Service, 2000a, section 4.3, pg 12). Post-fire numbers of westslope cutthroat trout and brook trout in Cameron Creek in 2001 and 2002 were similar to those that occurred prior to the 2000 fires (84-87 cutthroat > 4 inches per 1000 feet of stream; 90-96 brook trout > 4 inches per 1000 feet of stream). It appears that the fires of 2000 have had little effect on the westslope cutthroat trout and brook trout populations in the upper half of Cameron Creek.

In the Lyman Creek drainage, westslope cutthroat trout and brook trout are the only two fish species present, and occur in Schoolmarm Lake, the main stem of Lyman Creek on state land, and the North Fork of Lyman Creek up to the FDR 311 crossing on the Forest. Westslope cutthroat trout are the dominant species in the North Fork of Lyman Creek and outnumber brook trout by at least an 8 to 1 ratio. We do not know the species mix farther downstream on state and private land, but based on density patterns that occur elsewhere in the drainage, it is likely that brook trout increase in abundance as elevation declines. The total length of habitat occupied by westslope cutthroat trout is about 4.5 miles. The majority of the suitable habitat occurs on state and private land, only about 1.5 miles of suitable habitat occurs on the Forest. The combination of steep gradients and low streamflows near the FDR 311 crossing limit the upper distribution of fish in the North Fork of Lyman Creek.

Schoolmarm Lake is a 25-acre manmade reservoir that is formed by an earthen dam on lower Lyman Creek. The dam is a complete barrier to fish passage, and it isolates the Lyman Creek drainage from the rest of the Cameron Creek drainage. Since isolation has occurred, a migratory westslope cutthroat trout population has arisen in the lake. This population consists of larger adult cutthroat trout (size range 11-14 inches in length) that reside in the lake and spawn in the main stem of Lyman Creek and the North Fork. We do not have a good estimate of the total number of migratory adult cutthroat trout in Schoolmarm Lake, but it may exceed 50 fish.

The fires of 2000 burned about 93% of Lyman Creek and the North Fork, mostly at moderate severity with smaller, embedded pockets of high and low severity (USDA Forest Service, 2001a, pg 3-276). The fish-bearing reaches were mostly burned at moderate severity; the non-fish bearing headwater tributaries were mostly unburned. There have been no significant mudslides in the Lyman Creek drainage since the fires. Walk-through surveys conducted in August 2000 indicate that a fish kill occurred in the most severely burned portions of Lyman Creek and the North Fork of Lyman Creek (USDA Forest Service, 2000a, section 4.3, pgs 11-12). Based on the results of the 2003 electrofishing surveys, the westslope cutthroat trout population in the North Fork appears to be in the midst of a healthy recovery, while brook trout numbers are considerably lower than before the fires. The migratory cutthroat trout population in Schoolmarm Lake is critical to the recovery of the Lyman Creek cutthroat population. These migratory spawners survived the fires intact, and are thought to be critical to the rapid recovery of fish populations following fire (Rieman and Clayton, 1997; Gresswell, 1999; USDA Forest Service, 2000a, section 4.3, pg 14-15).

Westslope cutthroat trout are present at low densities throughout the lower mile of Guide Creek. Above that point, the stream becomes fishless due to minimal flows/depths. The westslope cutthroat trout in Guide Creek are small (most fish < 5 inches in length), and are believed to be resident fish.

The fires of 2000 did not burn the fish-bearing portion of Guide Creek (the lower mile). Further upstream, the riparian area was burned at low severity with smaller pockets of moderate and high severity (USDA Forest Service, 2001a, pg 3-276). There have been no mudslides in the Guide Creek drainage since the fires. The electroshocking data indicates that the fires did not cause declines in the westslope cutthroat trout population in Guide Creek.

The East Fork of the Bitterroot River near Cameron and Guide Creeks contains a mix of native and non-native fish species, including bull trout (native; uncommon-to-rare); westslope cutthroat trout (native; uncommon); rainbow trout (*Oncorhynchus mykiss*; non-native; abundant); westslope cutthroat trout X rainbow trout hybrids (uncommon); brown trout (*Salmo trutta*; non-native; common); brook trout (non-native; uncommon-to-rare); bull trout X brook trout hybrids (rare); mountain whitefish (native; abundant); slimy sculpin (*Cottus cognatus*; native; uncommon); longnose dace (*Rhinichthys cataractae*; native; common); longnose sucker (native; common); and largescale sucker (*Catostomus macrocheilus*; native; common).

Figure 3-2 East Fork of the Bitterroot River

The East Fork bull trout subpopulation is considered "depressed" in the lower half of the East Fork downstream of Meadow Creek, and "strong" in the upper half of the East Fork upstream of Meadow Creek (USDA Forest Service, 2000b, pgs 37-45; USDI Fish and Wildlife Service, 2001, pgs 26-27).

Downstream of Meadow Creek, the lower 27 miles of the East Fork contains a small population of migratory bull trout, probably numbering < 200 adult fish (USDA Forest Service, 2000b, pg 37). The lower half of the East Fork is dominated by rainbow trout and mountain whitefish, with lesser numbers of brown trout, westslope cutthroat trout, and brook trout. Brown trout and large rainbow trout are the dominant predatory salmonids in the lower East Fork (USDA Forest Service, 2000b, pg 37). Numbers of westslope cutthroat trout in the East Fork have been slowly increasing in recent years since the advent of catch-and-release angling regulations (Chris Clancy, Montana Department of Fish, Wildlife, and Parks fisheries biologist, personal communication, 2002).

Bull trout habitat in the lower half of the East Fork is considered nodal habitat (USDI Fish and Wildlife Service, 2001, pg 26). It primarily functions as a migratory corridor with over wintering adult-holding habitat in the larger pools. The fires of 2000 did not burn the riparian area along the East Fork between Cameron Creek and the East Fork trailhead. Post-fire monitoring in the East Fork has not detected a fish kill or a noticeable reduction in fish populations following the fires and mudslides (USDA Forest Service, 2000a, section 4.3, pgs 11-12; USDA Forest Service, 2001a, pg 3-278 to 3-279; USDA Forest Service, 2001b, pgs 112-113; PF, FISH-4, pg 14).

Population Connectedness

Fish passage in Cameron Creek is still an unknown. On private land, there are several irrigation diversions and culverts that have not been surveyed and could possibly function as fish passage barriers during certain times of the year. On State land, there are no man-made barriers to fish passage that we know of. Several culvert barriers were replaced on State land in autumn 2000 and no longer block fish passage. On Forest Service land, one culvert (FDR 1398) in the extreme upper reaches of Cameron Creek was surveyed in 2003 and is believed to block upstream juvenile and adult fish passage. Two others (FDRs 73123 and 73109) are unknowns and need to be surveyed. Because of their locations in the extreme upper reaches of Cameron Creek, these culverts restrict access to a very small length of suitable habitat, and are believed to have a minimal impact on the overall health and viability of the westslope cutthroat trout population in Cameron Creek.

The dam that forms Schoolmarm Lake is a complete fish barrier that isolates the entire Lyman Creek drainage from the rest of the Cameron Creek drainage. On the North Fork of Lyman Creek, the lower and upper culverts on FDR 13304 impede upstream fish movement. Both of the FDR 13304 culverts are proposed for removal in this project.

Further upstream, the FDR 311 culvert on the North Fork is also a barrier, but it does not affect fish movement because there is essentially no suitable habitat above the culvert. There are numerous other culverts in the Lyman Creek drainage, but none affect fish movement.

The East Fork Highway culvert on Guide Creek is a complete barrier to upstream fish passage due to a large vertical drop on the outlet. This culvert completely isolates the westslope cutthroat trout population on the Forest. It also prevents brook trout from moving upstream onto the Forest. There is another culvert on a private road about 20 feet downstream of the East Fork Highway culvert, but it does not appear to be a barrier to fish movement.

Genetic Integrity

Westslope cutthroat trout genetic purity has been tested in Cameron Creek, Schoolmarm Lake, and the lower East Fork of the Bitterroot River. All of the samples collected to date have been pure genetic strains. Although genetic testing in the East Fork has failed to detect westslope cutthroat trout hybridization with rainbow trout, a few cutthroat X rainbow hybrids have been captured during electroshocking surveys. Most likely, hybridization is occurring at low frequencies. Westslope cutthroat trout genetic purity has not been tested in Guide Creek and the North Fork of Lyman Creek. Based on morphological traits, the westslope cutthroat trout in those streams are suspected to be pure genetic strains.

Most of the bull trout in the East Fork appear to be pure genetic strains. However, brook trout are present in the lower ends of numerous tributaries to the East Fork (Laird, Warm Springs, Maynard, Camp, Cameron, Reimel, Tolan, Bertie Lord), and a few bull trout X brook trout hybrids have been captured in the river during electroshocking surveys. Most likely, hybridization is occurring in some of the tributaries at low frequencies.

Non-Native Species

Brook trout are widely distributed throughout the Cameron Creek drainage and occur together with westslope cutthroat trout in most stream reaches. Brown trout and rainbow trout are the dominant predatory salmonids in the lower East Fork. These non-native species probably pose a moderate risk to the persistence of westslope cutthroat trout due to hybridization concerns (rainbow), and a moderate-to-high risk to the persistence of bull trout due to predation (brown), competition (brown and brook), and hybridization (brook) concerns (Rieman et al., 1993). Non-native trout do not occur in Guide Creek upstream of the East Fork Highway.

Habitat Conditions

The cumulative effect of past timber harvest, road construction, and livestock grazing has reduced the quality of fish habitat in the North Fork of Lyman Creek. In the North Fork, habitat is below its natural potential, primarily due to sedimentation. In Cameron Creek above FDR 311, habitat is closer to its natural potential, and sediment levels are not excessive. Habitat conditions and sediment levels worsen as one moves downstream onto state and private land. In Guide Creek, fish habitat is below its natural potential due to road encroachment and sedimentation. The existing condition of the Inland Native Fish Strategy (INFISH) Riparian Management Objectives (RMOs) and sediment is discussed below. INFISH does not contain an RMO for sediment.

<u>Pools and Large Woody Debris</u>

On Forest Service land, the most important types of cover for fish in Cameron Creek, Guide Creek, and the North Fork of Lyman Creek are pools and large woody debris. Pools are common in Cameron Creek (121 pools/mile), the North Fork of Lyman Creek (211 pools/mile), and Guide Creek (193 pools/mile). All three streams are meeting the default RMO for pool frequency (Table 3-11). In Guide Creek and the North Fork of Lyman Creek, the quality of pool habitats has been degraded due to losses in volume and hiding cover caused by sedimentation. In the upper half of Cameron Creek, pool quality is near its natural potential.

On Forest Service land, large woody debris is common in Cameron Creek (63 pieces/mile) and the North Fork of Lyman Creek (130 pieces/mile), and uncommon in Guide Creek (21 pieces/mile). All three streams are meeting the default RMO of > 20 pieces/mile (Table 3-11). Cameron Creek and the North Fork of Lyman Creek flow through spruce/fir bottoms, and contain numerous large, downed woody debris pieces in their channels. On state and private land, large woody debris levels are below potential in both streams due to livestock grazing and riparian timber harvest. In Guide Creek, the felling of burned hazard snags in recent years by fire crews and fence construction crews along FDR 311 added numerous pieces of large woody debris to the channel, but most of this material was added to the non-fish bearing reaches of upper Guide Creek. In the long-term, the encroached location of FDR 311 reduces the recruitment of woody debris along the lower two miles of Guide Creek - a problem that likely won't go away. In all three streams, riparian timber harvest has not had a significant impact on woody debris levels on the Forest. Old clearcuts are located along the intermittent headwater tributaries, but generally avoid the fish-bearing reaches. There are numerous roads in the Cameron and Lyman Creek drainages, but the roads typically contour across slopes and cross streams at perpendicular angles instead of running right up the stream bottoms. At this point in time, the recruitment of burned trees from the 2000 fires is slowly increasing the amount of large woody debris in Cameron Creek, the North Fork of Lyman Creek, and Guide Creek.

Channel Stability

None of the streams are meeting the default RMO for wetted width-depth ratio (Table 3-11), but this is not unusual. The default RMO ratio (< 10) is a poor indicator to judge stream channel health, and needs revision. INFISH/PACFISH effectiveness monitoring data indicates that only 1% of the managed streams and 2% of unmanaged streams in the upper Columbia River basin are meeting the default RMO (Kershner et al., 2003). Based on our stream survey data, the channel in upper Cameron Creek is fairly stable, while the channels in the North Fork and Guide Creek have altered dimensions and reduced stability. In the North Fork, livestock grazing has widened the channel and increased sedimentation. In Guide Creek, road encroachment has created a narrow, incised channel with high sediment movement and low stability. Sedimentation has made these channels more sensitive to erosion and change than they historically were. In particular, the fires have 2000 have exacerbated the flashy watershed conditions that occurred in the Cameron Creek drainage prior to the fires. Phil Farnes, regional snow runoff forecaster, estimated that total runoff would increase in the Cameron Creek drainage by 12.8%, and 25-year storm flows would increase by 20%, as a result of the fires (USDA Forest Service, 2000a, section 4.2, pgs 40, 43).

Water Temperature

Prior to the fires of 2000, mean-maximum water temperatures exiting the Forest in Cameron Creek, Guide Creek, and the North Fork of Lyman Creek did not exceed 15° C (i.e. they met the default RMO of < 15° C over the warmest 7-day period). Since the fires of 2000, our monitoring indicates that mean-maximum water temperatures in Cameron Creek and the North Fork of Lyman Creek have risen by 2-5° C during the warmest parts of the summer, with mean-maximum temperatures in the range of 16-20° C during 2001-03 (USDA Forest Service, 2001b, pgs 116-117; PF, FISH-4, pgs 9-12). These temperature increases are caused by the fire's removal of large areas of riparian canopy shade and concurrent increases in solar radiation striking the stream surface. Maximum temperatures in the 16-20° C range are not high enough to eliminate westslope cutthroat trout, but they will increase physiological stress on the fish during the warmest periods, reduce feeding and growth rates, and could combine with other factors such as poor hiding cover to increase mortality. On the floor of French Basin, maximum water temperatures in Cameron Creek exceed 20° C for several weeks in July and August during most summers (range 20-22° C). Those temperatures are high enough to significantly stress westslope cutthroat trout (and reduce growth rates), and probably function as a seasonal thermal barrier to bull trout. Brook trout are a superior competitor over westslope cutthroat trout in warmer water temperatures, and have largely displaced westslope cutthroat trout on the floor of French Basin. In Guide Creek, our post-fire temperature monitoring data indicates that water temperatures have increased a smaller amount since the fires of 2000. The mean-maximum temperature over the warmest 7-day period increased from 13.4° C (1999) to 15.1° C (2002) to 15.3° C (2003), while the number of degree days increased from 685 (1999) to 709 (2002) to 765 (2003).

Sediment

In the North Fork of Lyman Creek and Guide Creek, sediment levels are higher than those found in comparable reference reaches. In those two streams, sediment is reducing pool volumes and hiding cover, and suppressing fish and macroinvertebrate productivity. The cumulative legacy effect of high road densities, numerous stream crossings, road encroachment (Guide Creek), and riparian livestock grazing are the primary causes of sedimentation. In Cameron Creek upstream of FDR 311 (i.e. the Forest Service portion of the drainage), sediment levels are similar to those found in comparable reference reaches, and do not appear to be having an adverse effect on the fishery. As one moves downstream in Cameron Creek onto state and private land, sediment levels increase and eventually dominate the stream bottom on the floor of French Basin.

Table 3- 11 Existing Condition of the INFISH RMOs in Cameron Creek, Guide Creek, and the North Fork of Lyman Creek

Stream and Site	Method of Survey	Width Class (feet)	Pools Per Mile	LWD Pieces Per Mile	Mean-Maximum Water Temp Exiting FS Land (°Celsius)	Wetted Width-Depth Ratio
Cameron Creek (FDR 311 crossing)	BNF habitat inventory	< 10	121	63	14.2° (1999) 16.0° (2000) * 16.6° (2001) * 16.0° (2002) * 18.3° (2003) *	24 *
Guide Creek (FS boundary)	BNF habitat inventory	< 10	193	21	13.4° (1999) 15.1° (2002) * 15.3° (2003) *	31 *
North Fork of Lyman Creek (FS boundary)	BNF habitat inventory	< 10	211	130	13.4° (1999) 18.3° (2001) * 16.9° (2002) * 20.1° (2003) *	27 *

* = RMO is not meeting the default value

Environmental Consequences

Effects Common to All Action Alternatives

The action alternatives would have the same effect on four of the five evaluation criteria: 1) water temperature, 2) water yield increases, 3) woody debris recruitment, and (4) migration barriers. The action alternatives differ in their potential to deliver sediment to streams. Therefore, the effect of sediment will be discussed individually by alternative. Sediment is the primary concern for the fishery in this project.

The action alternatives would have no effect on water temperatures or woody debris recruitment because there would be no removal of vegetation or shade from the RHCAs. On fish-bearing streams and perennial non-fish bearing streams, all trees, snags, and shade would be retained within two site potential tree lengths of stream channels (150 to 300 feet on both sides of streams). On intermittent streams, all trees, snags, and shade would be retained within one site potential tree length of stream channels (100 feet on both sides of streams). Water temperatures would be maintained in streams because no shade would be removed from stream channels or other contributing areas (USDI Fish and Wildlife Service, 1998, Appendix 5 – Temperature).

The action alternatives would produce negligible water yield increases. There would be no measurable changes in stream flows. Fish habitat structure and composition would not be altered by water yield increases because any increases that occur would be of a very low magnitude. Refer to the Watershed report for more details and the supporting documentation of these water yield predictions.

The action alternatives would remove the two fish culvert barriers that occur in the project area – the upper and lower FDR 13304 crossings on the North Fork of Lyman Creek. Removing these two culverts would reconnect the fragmented westslope cutthroat trout population in the North Fork. About 0.7 miles of underutilized spawning and rearing habitat would be opened up to year-round access. Allowing westslope cutthroat trout the opportunity to access their historic habitats in the North Fork would help to ensure maximum habitat usage by all life history stages and would improve opportunities for reproduction and survival. It would also make the population more resilient to future disturbances, and help speed the recovery process. The benefits of year-round passage would commence as soon as the culverts are removed.

The action alternatives would not remove the culvert barrier on Guide Creek at the East Fork Highway. Replacement of that culvert is not within the maintenance jurisdiction of the Forest Service. The action alternatives would not create any new barriers or impediments to fish movement.

Direct and Indirect Effects

Alternative 1

With no action, fish populations and habitat conditions will continue to slowly recover from the fires of 2000. As fire-killed snags rot and fall into streams, pool habitat and hiding cover will increase. Over the next 1-2 years, erosion and sedimentation from the burned areas will return to pre-fire levels. Research has shown than fire-related sediment increases decline to pre-fire levels about three years after a fire (DeBano et al., 1998; Elliot and Robichaud, 2001). Without additional disturbance, that trend would continue. Over the next several years, the westslope cutthroat trout population in the Lyman Creek drainage is likely to recover to its pre-fire levels. The research data on the sequence and timing of aquatic fire recovery is summarized in the Bitterroot Post-Fire Assessment (USDA Forest Service, 2000a, section 4.3, pgs 15-19).

Alternative 2

Alternative 2 could potentially add sediment to fish habitat via four sources:

1. Timber yarding activities (winter tractor yarding; winter or summer skyline yarding; temporary road construction and rehabilitation)
2. Log hauling (main haul route is FDR 311)
3. Road decommissioning (1.4 miles of road would be decommissioned; 12.6 miles would be closed year long; the surface of these roads would be decompacted, seeded and mulched)
4. Culvert removals (seven culverts would be removed in the Lyman Creek drainage, including the two fish barrier culverts on the North Fork of Lyman Creek on FDR 13304)

The majority of Alternative 2's sediment input would by produced by the culvert removals in the Lyman Creek drainage. Timber yarding activities, log hauling, and the decommissioning of road surfaces would produce smaller amounts of sediment input.

The following sediment effects on the fish-bearing streams are anticipated:

The North Fork of Lyman Creek and the Main Stem of Lyman Creek

Removing seven culverts would produce the majority of Alternative 2's sediment input in the Lyman Creek drainage. Replacing or removing culverts to eliminate fish barriers, although very beneficial in the long-term, causes a short-term, localized reduction in habitat because of the sediment deposition that occurs downstream of the culvert during the removal process. In recent years, several forests have attempted to quantify the magnitude, timing, and extent of this short-term sediment pulse, including the Lolo National Forest (USDA Forest Service, 1999), Flathead National Forest (USDA Forest Service, 1999), and Bitterroot National Forest (USDA Forest Service, 2001: pages 128-132). This monitoring indicates that with the application of sediment mitigation measures, 1-2 tons of sediment is typically produced at each culvert, and the majority of sediment deposition occurs within the first 150 feet downstream of the culvert. About 90% of the sediment is introduced in the first 30 minutes after the diversion is removed and the stream is allowed to pass through the new culvert (USDA Forest Service, 2001b: pages 129-132). It takes about 2-3 hours for turbidity to clear, and about 24 hours for suspended sediment concentrations in the water column to return to pre-replacement levels (USDA Forest Service, 2001b: pages 129-132). Although sediment mitigations (sediment traps; clean water diversions; straw mulch; timing of work restrictions, etc) are effective in minimizing sediment input during the replacement process, it is impossible to stop all sediment input from occurring. In Alternative 2, the seven culverts proposed for removal are considerably smaller than the ones monitored above. Because of their smaller sizes, less ground disturbance is needed to remove them, and the work would be of shorter duration. As a result, they are expected to contribute < 1 ton of sediment per culvert. In this project, we are liberally estimating that 1 ton of sediment would be produced at each of the seven culvert removal sites.

The sediment produced by removing the two fish barrier culverts on FDR 13304 would temporarily (as long as nine months) reduce the quality and availability of cutthroat habitat in the North Fork of Lyman Creek within the first 150 feet of stream below both sites. The habitat losses caused by removal-generated sedimentation would displace a few cutthroat trout from habitats such as small pools and substrate interstices, and could contribute to reduced growth and mortality of some juvenile cutthroat trout over a period of several weeks to months following the removals. Displacement of cutthroat trout is not likely to persist beyond the next snowmelt runoff period (i.e. the following May or June) due to flushing and dispersal of sediments from the area, but sediment may affect other fish to a lesser degree as it is routed downstream through the Lyman Creek system. Assuming that sediment deposition would occur throughout the first 150 feet below each culvert, a ballpark estimate of the number of westslope cutthroat trout potentially displaced would be < 30 fish.

There is a higher risk that the salvage yarding activities in Alternative 2 would deliver sediment to the North Fork of Lyman Creek than the salvage yarding activities in Alternative 3 (refer to the Watershed section for WEPP model sediment estimates). This is because Alternative 2 contains more ground-based yarding acres, and allows ground-based yarding on areas burned at moderate and high severity. In areas burned at moderate and high severity, there is greater chance of ground-based equipment causing ground disturbance and reductions in vegetative cover, which results in larger estimates of sediment delivery to streams. Without large storms, it is very unlikely that eroded sediments would be able to exit the harvest units and flow through RHCA buffers in any appreciably quantities. This prediction is based on the extensive monitoring of RHCA buffers in the Burned Area Recovery project. During 2002, RHCA buffers were monitored following salvage harvest in 10 winter tractor and 32 summer/winter skyline units (Project File- FISH-4, pgs 4-6). This monitoring failed to find visible evidence of sediment moving from the harvested areas into bordering RHCA buffers. Despite the lack of field evidence, there is some risk that if a large storm hit the salvage units after the yarding was completed, there would be more erosion and sediment delivery to the North Fork. The WEPP probabilities of salvage yarding activities delivering sediment to streams are relatively low (3% chance in unburned units or units burned at low severity; 17% chance in units burned at moderate or high severity – refer to the Watershed section for more details).

The North Fork of Lyman Creek is a much smaller stream than Cameron Creek, and its fish habitat is more vulnerable to additional sediment input because it already contains high sediment levels. If a large storms occurs during the first year following the culvert removals, increased sediment delivery from the salvage units coupled with sediment inputs from the culvert removals could collectively reduce the quality of westslope cutthroat trout habitats below the culvert removal sites in the North Fork by contributing additional sediment infill to pools, hiding cover, and spawning gravels (several authors referenced in USDA FS and USDI BLM, 1997, pg 1139 and Chamberlin et al., 1991). Increased sediment infill in the stream bottom negatively affects westslope cutthroat trout by reducing egg survival, increasing mortality of rearing juveniles, reducing aquatic insect production, and reducing hiding and over wintering cover for adults (several authors cited in USDA FS and USDI BLM, 1997, pgs 1139 and 1198 and Hicks et al., 1991). It may also contribute to habitat conditions that favor non-native brook trout over westslope cutthroat trout (USDA FS and USDI BLM, 1997, pg 1198).

Based on monitoring of Burned Area Recovery road decommissioning activities that were conducted in the Robbins Gulch drainage in autumn 2002 (Project File- FISH-4, pgs 7 and 20; and FISH-5), it is very unlikely that sediments eroded from the decommissioned road prisms would leave the site, flow across the forest floor and through RHCAs for several hundred feet, and enter streams in any measurable amounts. Typically, sediments eroded from decommissioned roads only travel several feet beyond the road shoulders before being stopped by vegetative filters. Sediment that can directly access a stream channel, such as at sites where culverts are removed, can travel longer distances and poses more of a risk to fish. The effect of sediment entering streams where culverts are removed on decommissioned roads has been factored into the culvert removal sediment effects described above.

Under the worst case scenario, the total sediment produced by Alternative 2 would not drive the westslope cutthroat trout population into extinction in the Lyman Creek drainage, but it could reduce productivity, growth rates, and juvenile/adult survival rates in scattered habitats in the drainage for a couple of years.

Schoolmarm Lake

Any sediment that gets routed downstream out of the North Fork and main stem of Lyman Creek would eventually be deposited on the bottom of Schoolmarm Lake. This deposition is likely to have a negligible effect on the migratory cutthroat trout that reside in the lake because the bottom of the lake is already completely sand and silt covered, and another thin layer of silt/sand on the bottom would not smother essential hiding cover or food sources.

Cameron Creek
Cameron Creek would not be affected by culvert removal-generated sediment. Similar to the North Fork of Lyman Creek, the salvage yarding activities in Alternative 2 would have a higher risk of adding sediment to fish habitat in Cameron Creek than the salvage yarding activities in Alternative 3. On Forest Service land, Cameron Creek is 3-4 times larger than the North Fork of Lyman Creek, with better channel stability. It does not contain excessive amounts of sediment in its stream bottom, and its fish habitat is more resilient to sedimentation than the North Fork. There is more risk of sediment delivery with Alternative 2, but because of the larger size and cleaner stream bottom in Cameron Creek, it would be difficult to measure/detect a reduction in westslope cutthroat trout numbers and habitat quality. With large storms, there could be some localized sedimentation of westslope cutthroat trout habitat, but it is unlikely that sedimentation would occur to the degree that we could see it and measure it, or detect changes in fish populations. The most likely scenario in Cameron Creek is that any sediment that manages to pass through the RHCA buffers and enter the stream would get routed downstream and eventually deposited in the lower reaches on state and private lands where sediment already dominates the stream bottom. Sediment produced in the Lyman Creek drainage would not enter the lower reaches of Cameron Creek in any meaningful amounts because it would be blocked and trapped by the dam on Schoolmarm Lake.

Guide Creek
Log hauling down 2.4 miles of FDR 311 has the potential to increase road sediment inputs to Guide Creek. A small westslope cutthroat trout population is present in the lower mile of Guide Creek adjacent to FDR 311. Monitoring of log hauling on FDR 311 during the 2002-03 Burned Area Recovery salvage sales indicates that with proper maintenance (snow plowing, grading, ditch work, etc), hauling on FDR 311 does not contribute large sediment inputs to Guide Creek or the East Fork (Project File- FISH-6). FDR 311 is considered one of the more stable winter haul routes on the Forest. The 2.4 mile segment along Guide Creek contains a gravel surface and good road prism drainage characteristics (the lower mile is outsloped, the rest is insloped). In Alternative 2, log hauling is expected to produce a small sediment increase in Guide Creek. The increase is predicted to be too small to cause detectable changes in the composition of the stream bottom or changes in westslope cutthroat trout numbers and habitat quality.

The East Fork of the Bitterroot River
The total amount of Alternative 2's sediment that eventually reaches the East Fork would be miniscule, immeasurable, and discountable. The two sources of input would be Guide Creek and Cameron Creek, neither of which would contribute meaningful inputs. As a result, there would be no visible or detectable changes in fish populations and habitat quality in the East Fork. Alternative 2 would have no significant effect on proposed bull trout critical habitat in the East Fork.

Alternative 3
Alternative 3 could potentially add sediment to fish habitat via same four sources as Alternative 2. However, it has a considerably lower risk of producing sediment from salvage yarding activities (refer to the Watershed section for more information on WEPP model sediment estimates). Removing seven culverts in the Lyman Creek drainage, an action taken to improve the long-term health of the fishery, would produce the majority of Alternative 3's sediment.

The following sediment effects on the fish-bearing streams are anticipated:

The North Fork of Lyman Creek and the Main Stem of Lyman Creek
In Alternative 3, the culvert removals would produce nearly all of the sediment input in the Lyman Creek drainage. Effects of the sedimentation caused by the culvert removals and road decommissioning on westslope cutthroat trout are the same as those described for Alternative 2. The WEPP model predicts that with large storms, Alternative 3's salvage yarding activities have the potential to contribute near zero amounts of sediment to the North Fork and its tributaries (refer to the Watershed section). With Alternative 3, any sediment produced by the salvage yarding activities would be too small to have a detectable negative effect on westslope cutthroat trout habitat and populations.

Schoolmarm Lake
Effects would be indistinguishable from those described for Alternative 2.

Cameron Creek
The WEPP model predicts that in the event of a large storm, the salvage yarding activities in Alternative 3 have the potential to add roughly one ton of sediment to upper Cameron Creek (refer to Table 3-8 in the Watershed section).

This is an 87% reduction from Alternative 2. After passing through the RHCA buffers, it is unlikely that we would be able to see and measure this small amount of sediment in the stream bottom of Cameron Creek. Monitoring of streams in the Burned Area Recovery project has failed to detect measurable/detectable changes in fish habitat quality and population numbers attributable to salvage harvest-generated sediment (Project File- FISH-4, pg 15), in spite of much higher sediment inputs predicted by the WEPP model in that project (USDA Forest Service, 2001a, pgs 3-119, 3-150, and 3-175). Sediment produced by Alternative 3 would be immeasurable in the stream bottom and would not cause detectable changes in westslope cutthroat trout numbers and habitat quality. Sediment produced in the Lyman Creek drainage would not enter the lower reaches of Cameron Creek in any meaningful amounts because it would be blocked and trapped by the dam on Schoolmarm Lake.

Guide Creek

In Alternative 3, the number of log trucks coming down FDR 311 would be about half as much as Alternative 2. A corresponding reduction in erosion potential and sediment production from the road surface is expected. Hauling-caused sediment inputs to Guide Creek would be too small to cause detectable changes in the composition of the stream bottom or detectable changes in westslope cutthroat trout numbers and habitat quality.

The East Fork of the Bitterroot River

Effects would be indistinguishable from those described for Alternative 2

Analysis Area

Cumulative Effects

For fisheries, the cumulative effects analysis area consists of the Cameron Creek drainage (including Lyman), the Guide Creek drainage, the Jennings Camp Creek drainage, and the East Fork of the Bitterroot River downstream of the mouths of those streams. These areas were chosen because past/present/future activities in those drainages have or will contribute sediment to the project area, and that sediment has the potential to combine with sediment from the Lyman salvage activities to cumulatively degrade fish habitat. With the exception of the 2000 fires, projects and events occurring upstream of the Jennings Camp Creek drainage were not included in the cumulative effects analysis area because man's activities in the upper East Fork drainage produce negligible sediment inputs to the East Fork, and do not alter woody debris inputs or water temperatures in the river to a significant degree.

Described below are several activities and natural events within the cumulative effects analysis area that already have, or will likely occur in or near the project area in the next three years. The past activities and natural events have contributed to create the existing condition that is described in the fisheries affected environment section of this EA. The activities listed below may produce environmental effects on aquatic resources relevant to this project. Activities that are likely to contribute similar cumulative effects have been grouped. A short paragraph summarizes the cumulative effects caused by each group of activities.

Past, Ongoing, and Future Activities that APPLY to the Fisheries Cumulative Effects Analysis

- The natural effects of the 2000 fires (hydrophobic soils, increased sediment inputs, mudslides in some areas)
- Road construction, use, and maintenance (Forest Service, state, and private)
- Highway construction, use, and maintenance (U.S. 93 and East Fork Highway)
- Highway 93 reconstruction (Sula north/south and Conner north/south phases)
- Forest Service grazing allotments (East Fork, Sula Peak, and Shirley Mountain)
- Livestock grazing on state and private lands
- Pre-2000 timber harvest (Forest Service, state, and private)
- Post-2000 DNRC salvage harvest (Sula State Forest)
- Post-2000 Forest Service salvage harvest (Elk Point I, Elk Point II, Little Bull, Big Bull, Bitter Camp, and Guide salvage sales)
- Post-2000 salvage harvest on private lands
- Suppression and rehabilitation activities in the 2000 fires (dozer line construction and rehabilitation, culvert replacements, road repairs, and other BAER activities)
- Trail construction, maintenance, and use (OHV, horse, and hiker)

- Subdivision-associated soil disturbances (roads, fields, etc)

These activities cumulatively interact by adding sediment to the fishery. Sediment is the cumulative effect of concern for the fishery in the Lyman salvage project. Collectively, these activities are responsible for producing most of the high sediment levels that are present in the lower reaches of Cameron Creek, all of the Lyman Creek drainage, all of Guide Creek, and portions of the lower East Fork of the Bitterroot River. From largest to smallest sediment producers, these activities rank as: (1) sediment increases caused by the 2000 fires; (2) roads and highways; (3) livestock grazing; (4) timber/salvage harvest (all ownerships); (5) fire rehabilitation activities (culvert replacements, dozer line rehab, contour felling, etc); (6) trails/OHVs; and (7) subdivision.

Over the past three years, greatly increased erosion rates from the 2000 burned areas has contributed large amounts of sediment to Cameron Creek, Lyman Creek, Guide Creek, and the lower East Fork. Mudslides produced very large sediment pulses in Camp Creek, Laird Creek, Medicine Tree Creek, the Sula Peak area, and the lower East Fork during July 2001, and their raw channels have continued to produce sediment pulses during thunderstorms (August, 2002) and rapid snowmelt events (March, 2003). Smaller mudslide channels occurred in portions of French Basin, but not on the scale of those in the Laird Creek drainage. The mudslide-generated sediment pulses will gradually subside with time as the raw banks along the mudslide channels slump, stabilize, and revegetate. Without mudslides, the fire-generated sediment inputs are expected to continue their ongoing decline to near pre-fire levels over the next 1-3 years. Fire-generated sediment pulses will occur for longer durations where mudslide channels are present.

At present, roads (Forest Service, state, and private) are the second highest sediment producer in the cumulative effects analysis area. Prior to the 2000 fires, roads were the largest sediment producer, and are likely to return to that top status over the next 1-3 years as erosion rates from the 2000 burned areas continue their decline to pre-fire levels. The Cameron, Lyman, and Guide Creek drainage contain high road densities and numerous stream crossings (refer to the Watershed section for more detailed roads information). Sediment modeling conducted for the Burned Area Recovery FEIS indicates that roads contribute an estimated 308 tons of sediment per year to streams in the cumulative effects analysis area. This total breaks out as 138 tons from the Cameron Creek drainage (includes the Lyman Creek drainage), 62 tons from the East Fork drainage between Meadow Creek and Cameron Creek (includes the Guide and Jennings Camp Creek drainages), and 108 tons from the East Fork drainage downstream of Cameron Creek (BAR FEIS project file sediment modeling results, WATERSHED-71). In summary, with the short-term exception of the 2000 fires, sediment from roads has the greatest cumulative negative impact on fish habitat in the Cameron Creek, Lyman Creek, and Guide Creek drainages.

Livestock grazing in riparian areas is another large sediment producer in the Cameron and Lyman Creek drainages. The majority of lands in the Cameron, Lyman, and Guide Creek drainages are grazed at varying intensities for some part of the year. Riparian livestock grazing is widespread on private lands on the floor of French Basin and on leased state lands. On the floor of French Basin, a couple small parcels of Forest Service land are periodically grazed along Cameron Creek near Pasture Draw (Sula Peak allotment). In the Forest Service headwaters, riparian livestock grazing primarily occurs at numerous road stream crossings, and in the riparian bottoms along the North Fork of Lyman Creek and the upper main stem of Lyman Creek. Based on our stream survey data, the stream channel in upper Cameron Creek above FDR 311 is relatively stable and only minimally affected by livestock grazing. In the North Fork and main stem of Lyman Creek, livestock grazing from the East Fork allotment has widened the channels, reduced bank stability, and increased sedimentation. Livestock grazing from the Shirley Mountain allotment also occurs in the Guide Creek drainage. Livestock impacts along Guide Creek and its tributaries are light and scattered. The heavier use is concentrated along road sides and the upland grasslands.

On all land ownerships, the Cameron Creek drainage (includes the Lyman Creek drainage) was primarily managed for timber production prior to the 2000 fires. The pre-fire equivalent clearcut area (ECA) was 26%. 60% of the Cameron Creek drainage was burned at moderate or high severity in 2000, which increased the ECA from 26% to 61%. The Cameron Creek hydrograph responds quickly to storms and rapid snowmelt events. During storms, water and sediment yields in Cameron Creek increase quickly and are responsible for the majority of sediment and turbidity increases in the lower East Fork. The Guide Creek drainage was also primarily managed for timber production, but it was not harvested as much as the Cameron and Lyman Creek drainages, and is not as flashy as Cameron Creek.

Since the fires of 2000, nearly all of the lands in the Sula State Forest have been salvage harvested. The vast majority of the salvage harvest was conducted during winter, with good-to-excellent winter harvest conditions for soil protection. The bulk of the salvage harvest occurred during winter 2000-01, with smaller bug-killed harvest occurring in winters 2001-02 and 2002-03. A small amount of summer skyline harvest occurred during summer, 2001. The state used the narrower width Streamside Management Zones (SMZs, 50-100 feet wide) for their salvage harvest projects versus the wider 200-300 foot RHCA buffers on the Forest. Harvest along the narrower SMZ buffers has resulted in small reductions in shade, and will produce small reductions in woody debris recruitment along Cameron Creek and Lyman Creek over time (BAR FEIS project file, DNRC monitoring results, RFPI-15). Elevated stream temperatures are a concern in the Cameron and Lyman Creek drainages. The state sales and associated log hauling caused small sediment increases in Cameron and Lyman Creeks and their tributaries (USDA Forest Service, 2001a: pg 3-291; BAR FEIS project file, DNRC monitoring results, RFPI-15).

National Forest salvage harvest started in the upper rim of French Basin in February 2002 (Elk Point I and II sales), and continued through summer 2002 (Elk Point I, Little Bull, and Big Bull sales), and winter 2002-03 (Guide and Bitter Camp sales). Small areas of salvage harvest will be completed in the Elk Point I, Big Bull, Guide, and Bitter Camp sales during summer 2003. The remaining areas primarily consist of small, helicopter-yarded units using existing landings. With the use of expanded RHCA buffers (200-300 foot protection widths around all streams) and soil protection mitigations, monitoring of RHCAs and fish populations has failed to detect any movement of sediment from the salvage harvest units into the RHCAs or measurable sediment effects on fish populations or habitat (Project File- FISH-4, pgs 4 and 15). Monitoring also indicates that the sediment predictions made for salvage harvest in the Burned Area Recovery FEIS (USDA Forest Service, 2001a: pgs 3-295 to 3-299) were overestimated (Project File-FISH-4, pg 15).

Small areas of private salvage harvest occurred in the Cameron and Lyman Creek drainages in 2000-2002. These sales typically removed nearly all of the burned snags, but did not have much effect on fish habitat because they occurred well away from fish-bearing streams and their tributaries. Considerable erosion is visible on the skid trails, but because of their benign locations relative to streams, it is unlikely that significant sediment inputs to streams occurred from these trails. Private salvage along the East Fork of the Bitterroot River between the D-2 housing area and the Medicine Tree has reduced shade and woody debris recruitment to the river, but has not caused insignificant erosion and sediment input because of the flat terrain.

Monitoring indicates that the rehabilitated dozer lines from the 2000 fires have recovered well, and are not sediment producers (USDA Forest Service, 2001a: pg 3-290; USDA Forest Service, 2001b: pgs 89-91). Most Forest visitors would have difficulty finding the rehabilitated 2000 dozer lines. In most cases, the only noticeable feature is the parallel arrangement of slash across the trails. Numerous culverts were replaced in the Cameron, Lyman, and Guide Creek drainages following the fires in autumn, 2000 (USDA Forest Service, 2001a: pg 3-290). Short-term pulses of sediment occurred during the replacement process at each of these sites (USDA Forest Service, 2001a: pg 3-290). The cuts and fills surrounding these culverts are now 2 ½ years old, and have stabilized and revegetated. Sediment inputs are no longer occurring from these sites. Contour felling occurred in the uplands outside of RHCAs and had no effect on sediment or other fish habitat features. In 2001 and 2002, several miles of FDRs 311, 717, and 723 were graveled along Jennings Camp Creek and the headwaters of Cameron and Lyman Creeks following the fires. This action was positive for the watershed. It has greatly reduced road rilling and sediment production on some of the most-heavily used road segments.

OHV trails are scattered throughout the Cameron, Lyman, and Guide Creek drainages, but they generally follow ridges and tend not to cross or parallel fish-bearing streams. Small stream crossings occur in scattered locations, but we know of no significant sources of OHV-caused sediment input to fish habitat. Hiking and/or non-system horse trails generally do not parallel streams in the analysis area, and are not meaningful sediment producers.

Subdivision primarily is occurring along the East Fork of the Bitterroot River between Jennings Camp Creek and Tolan Creek. It is not a major sediment producer, but does remove patches of riparian shade from the river and contributes to warmer river temperatures, increased nutrient loads, reductions in woody debris recruitment, and reduced bank stability.

In the Cameron Creek drainage (including the Lyman Creek drainage), sedimentation is the primary cumulative effect of concern on Forest Service land, and is even more prevalent on state and private lands. Sediment from the sources described above has combined to reduce the quality of spawning gravels and pools in Cameron Creek and its tributaries. Roads, riparian livestock grazing, and the 2000 fires are the main contributors. On private lands, widespread riparian grazing has widened stream channels, reduced undercut bank cover, removed shade, and increased stream temperatures. The majority and worst of these negative habitat changes have occurred on private lands along the floor of French Basin. Habitat conditions are better on National Forest land in the headwaters. Although they are still common in the upper half of the Cameron Creek drainage, westslope cutthroat trout production, growth, and survivorship are being suppressed by cumulative sediment accumulations in the lower half of the drainage. Increased sediment levels have contributed to the spread of brook trout in the Cameron Creek drainage by creating habitat conditions more favorable for that species. Where brook trout numbers have increased, westslope cutthroat trout numbers have usually declined.

In the Guide Creek drainage, sedimentation is the primary cumulative effect of concern to the small westslope cutthroat trout population in the lower mile of Guide Creek. Roads are the main contributors of sediment. Westslope cutthroat trout production, growth, and survivorship are being suppressed by cumulative sediment accumulations. Fortunately, brook trout have not been found in Guide Creek.

In the East Fork of the Bitterroot River, sediment inputs have increased substantially in recent years with the fires, mudslides, and highway construction. However, the river is naturally resilient to higher sediment influxes and has been able to transport the majority of this material with no significant changes in habitat, fish population numbers, and species distributions. Fish population monitoring conducted in the East Fork since the fires of 2000 indicates that trout numbers are similar to pre-fire levels. Highway encroachment and its associated removal of the riparian overstory is the primary cumulative effect to the fishery in the lower East Fork. Habitat conditions in the lower half of the East Fork are well below their potential due to reductions in channel length, shade, woody debris recruitment, and habitat complexity, all caused by the encroachment of U.S. Highway 93. Highway reconstruction projects such as the recently completed Sula north/south phase and the proposed Conner north/south phase add sediment to the river in the short-term, but improve fish habitat in the long-term by increasing channel length, habitat complexity, and hiding cover. In the East Fork, the superior habitat that holds the most fish occurs in the channel meanders, and both highway reconstruction projects have or would increase channel meanders. Riparian livestock grazing is spotty along the lower East Fork. Some grazing occurs near the Trinity Ranch, and heavy grazing occurs between Cameron Creek and Tolan Creek. The rest of the river is generally not grazed. Over time, grazing in spots has widened the river channel, reduced shade, reduced woody debris recruitment, and contributed to warmer river temperatures. Grazing has had its greatest impacts between Tolan and Cameron Creeks.

- Ditches, diversions, and irrigation dewatering
- Fish stocking (past stocking on the Forest, present and future stocking in private ponds)

Water diversions are present on lower Cameron Creek and the East Fork of the Bitterroot River. Nearly all of the diversions occur on private lands. The diversions exacerbate other existing habitat problems such as sedimentation, reduced hiding cover, and warmer stream temperatures. They contribute to the suppression and displacement of native fish species by making conditions for non-native competitive species (e.g. brook, brown, and rainbow trout) that are more tolerant of degraded habitat conditions. With the exception of the earthen dam that forms Schoolmarm Lake, we know of no diversions that currently block fish movement in the analysis area.

Rainbow, brown, and brook trout were widely stocked in the East Fork and its larger tributaries in the first half of the 1900's. These species have established themselves and spread from their original stocking locations. They now dominate the fish community of the lower East Fork (rainbow and brown trout) and the lower half of French Basin (brook trout). The cumulative effect of their presence is that they are suppressing, and over time could potentially displace, bull trout and westslope cutthroat trout from areas where they historically occurred. Degraded habitat conditions contribute to the replacement of native trout species by non-native species. There is some risk that brook trout could eventually spread into Guide Creek and threaten the persistence of the small native westslope cutthroat trout population upstream of the East Fork Highway. The perched culvert barrier on the highway currently prevents brook trout encroachment.

The effect of fish stocking in private ponds is an unknown in the project area. There are a couple of private ponds in the lower end of the Cameron Creek drainage, but as far as we know, non-native trout are not invading native trout habitat from those areas. No fish stocking occurs on Forest Service and state lands. The Montana Department of Fish, Wildlife, and Parks regulate the stocking of private ponds. Non-native trout are not allowed to be stocked in ponds unless devices are in place to prevent their spread into nearby streams and rivers.

- Hunting, fishing, and dispersed recreation
- Personal use firewood cutting and Christmas tree cutting

Dispersed campsites are scattered throughout the analysis area, but none are causing significant reductions in shade or woody debris recruitment or meaningful sediment inputs. Fishing pressure is low in Cameron Creek and basically absent in the Lyman and Guide Creek drainages due to the small sizes of the streams. Fishing pressure is heavy on the East Fork, but bull trout and westslope cutthroat trout are protected by catch-and-release regulations that appear to be working relatively well. Firewood and Christmas tree cutting is focused along roadsides and usually avoids stream bottoms. A potential woody debris snag is removed for firewood on occasion, but these are highly scattered and uncommon. There are no known areas where firewood or Christmas tree harvest is having a negative effect on fish habitat.

- Past noxious weed treatments (Forest Service and private lands)
- Roadside herbicide spraying
- Herbicide spraying (all areas covered in the Weed FEIS and continued roadside spraying)

There are no indications or monitoring evidence that past and ongoing herbicide spraying is having a negative effect on water quality and aquatic organisms. With current mitigations and restrictions on herbicide spraying, water quality and aquatic organisms would be adequately protected during future herbicide applications such as those proposed in the Weed EIS.

- Burned Area Recovery road decommissioning, graveling, and BMP upgrades
- Replacement of the fish barrier culvert on the FDR 311 crossing of Hart Creek

These activities would produce localized and insignificant sediment inputs to streams in the short-term during implementation. After 1-3 years, when the disturbed sites have been effectively revegetated, they will contribute to reduce sediment production from the road network, reduced fragmentation of the westslope cutthroat trout population in Hart Creek (a major tributary to Cameron Creek), and an incremental improvement in overall watershed health.

Past, Ongoing, and Foreseeable Future Projects/Activities that DO NOT APPLY to the Fisheries Cumulative Effects Analysis

- Tree planting activities
- Outfitter and guide activities
- Douglas fir bark beetle infestations and future Forest responses to the beetles
- Mushroom and special products harvest
- Middle East Fork manual fuels/burning project
- Upper Jennings small timber sale
- Robbins Gulch salvage sale (Burned Area Recovery sale)
- Weird salvage sale
- Routine maintenance of Forest Service facilities (campground, trailheads)

These activities were not included in the fisheries cumulative effects analysis because they have no realistic potential to impact fish habitat and populations in Cameron Creek, Lyman Creek, Guide Creek, and the East Fork of the Bitterroot River. These projects either do not directly contribute sediment or water to fish habitat in the project area (e.g. Weird and Robbins Gulch salvage sales), do not have negative impacts on fish habitat or RHCAs (tree planting, outfitter and guides, manual fuels/burning projects, Upper Jennings small timber sale), or are located too far outside of the project area and produce negligible increases of sediment and water to the East Fork of the Bitterroot River.

In recent years, a Douglas fir bark beetle infestation has been spreading along both sides of the East Fork between the Springer Memorial and the Sula Store. It is thought that the areas burned by the fires of 2000 (Guide, Jake's Draw, and Jennings Camp Creek drainages) will experience increased beetle activity over the next couple of years. At this point in time, it is too speculative to predict the cumulative effect of future beetle projects on the fishery. Any future beetle projects would have to comply with INFISH and go through bull trout consultation. After meeting those standards, any effects on the fishery are likely to be small and mitigated to the greatest possible extent. Potential Forest response projects to the beetles could originate in future analyses such as the Middle East Fork watershed analysis (autumn 2003). However, for the sake of this cumulative effects analysis, there are no proposed actions at this time, and guessing what those might be is too speculative to shed any meaningful light on fisheries cumulative effects.

Cumulative Effects

Alternative 1

The cumulative effect of Alternative 1 would be a gradual return to the habitat and population conditions that occurred prior to the 2000 fires. In the more severely burned reaches, the long-term benefits of fire (increased woody debris recruitment, hiding cover, and channel complexity) would partially offset the sedimentation impacts caused by past management activities. The short-term negative impacts of fire (increased sedimentation, channel instability, and water temperatures) would gradually diminish over the next few years (erosion and sedimentation) to a decade (water temperatures) (USDA Forest Service, 2000a, section 4.3, pgs 15-19). No road decommissioning or culvert removals would occur. The presence of two fish passage barriers on FDR 13304 would continue to fragment/isolate the westslope cutthroat trout population in the North Fork of Lyman Creek. Alternative 1 would not contribute additive effects that could combine with the effects from past, ongoing or reasonably foreseeable activities. Watershed conditions would continue on the same trend as currently exists.

Alternative 2

The bull trout and westslope cutthroat trout populations in the project area are part of larger meta-populations that include migratory fish from the East Fork of the Bitterroot River. Viability for these meta-populations is considered “depressed” in the lower half of the East Fork downstream of Meadow Creek, and “strong” in the upper half of the East Fork upstream of Meadow Creek (USDA Forest Service, 2000b, pgs 37-45; USDI Fish and Wildlife Service, 2001, pgs 26-27). Viability is depressed primarily because of habitat alternations (sedimentation has had the biggest impact in the tributaries to the East Fork) and displacement by non-native trout species (Rieman et al. 1993). The cumulative effect on bull trout and/or westslope cutthroat trout population viability is discussed for each local population in the project area in the following paragraphs.

In the North Fork of Lyman Creek, Alternative 2’s sediment, when combined with existing high sediment levels and sediment produced by the other activities described above, has more of a risk of causing habitat reductions and displacement of westslope cutthroat trout, as compared to Alternative 3. In the short-term, because of its higher sediment risk, Alternative 2 has more potential to depress the viability of the local westslope cutthroat trout population in the Lyman Creek drainage for a longer duration than Alternative 3. In the long-term, the removal of two culvert barriers on FDR 13304 would re-establish connectivity within the cutthroat population, and over time, would eventually benefit the population and strengthen viability. The road decommissioning would produce incremental improvements in watershed health.

In Cameron Creek, the majority of Alternative 2’s sediment, when combined with sediment produced by the other activities described above, has the potential to cause minor habitat reductions or temporary displacement of a few westslope cutthroat trout for short periods of time. Most of Alternative 2’s sediment would eventually be routed downstream and deposited in low gradient, depositional areas on state and private land already dominated by sand/silt bottoms. Along the way, project-caused sediment would be diluted and scattered over several miles of lightly occupied westslope cutthroat trout habitat in lower Cameron Creek. It is unlikely that we would be able to detect a change in habitat conditions or cutthroat population numbers in Cameron Creek. For those reasons, Alternative 2 has a low risk of depressing the viability of the local westslope cutthroat trout population in Cameron Creek.

In Guide Creek, sediment produced by log hauling would be contributed to existing high sediment levels. However, because the amount of sediment produced by hauling would be small and masked by the existing sediment yield, the cumulative effect on westslope cutthroat trout is likely to be insignificant. Alternative 2 has a low risk of depressing the viability of the local westslope cutthroat trout population in Guide Creek.

Any sediment that reaches the East Fork of the Bitterroot River from Alternative 2 would be miniscule and discountable. There would be no significant cumulative effect on proposed bull trout critical habitat in the East Fork. Alternative 2 would maintain the viability of the local bull trout and westslope cutthroat trout populations in the East Fork.

Alternative 3

In the North Fork of Lyman Creek, Alternative 3's sediment, when combined with existing high sediment levels and sediment produced by the other activities described above, has a lower risk of causing habitat reductions and displacement of westslope cutthroat trout, as compared to Alternative 2. In the short-term, sediment produced by Alternative 3 could depress the viability of the local westslope cutthroat trout population in the North Fork of Lyman Creek, but to a lesser degree than Alternative 3. The sediment responsible for the temporary decline in viability would be caused by implementing watershed improvement activities (culvert removals and road decommissioning). In the long-term, viability would be strengthened because all of the barriers to fish movement would be eliminated, and the road decommissioning would lead to incremental improvements in watershed health.

In Cameron and Guide Creeks, the cumulative effect of Alternative 3 would be a milder version of Alternative 2. Alternative 3 would maintain the viability of the local westslope cutthroat trout populations in Cameron and Guide Creeks.

Any sediment that reaches the East Fork of the Bitterroot River from Alternative 3 would be miniscule and discountable. There would be no significant cumulative effect on proposed bull trout critical habitat in the East Fork. Alternative 3 would maintain the viability of the local bull trout and westslope cutthroat trout populations in the East Fork.

Consistency with the Bitterroot Forest Plan and Other Regulation

All of the alternatives are consistent with the Bitterroot Forest Plan as amended by INFISH and the other fisheries regulatory direction. In Alternatives 2 and 3, sediment produced by the culvert removals and road decommissioning would retard the attainment of the pool frequency RMO in the North Fork of Lyman Creek in the short-term, but would contribute to better watershed and pool conditions in the long-term.

VEGETATION

Introduction

The Bitterroot National Forest is in the Middle Rocky Mountain Steppe/Coniferous Forest/Alpine Meadow Ecoregions in the Temperate Steppe Division of the Dry Domain (Bailey, 1994). At the sub-region scale, the area is in the Bitterroot Mountain Section (McNab, 1994). Steep dissected mountains with sharp crests and narrow valleys characterize the Bitterroot. Climate is cool and temperate with some maritime influence, producing relatively mild winters and dry summers. Most precipitation occurs as snow in the fall, winter, and spring. Potential natural vegetation is Douglas-fir forest, western ponderosa forest, spruce-fir forest, and foothills prairie. Timberline occurs at about 8,800 feet. Common tree species include western larch, lodgepole pine, Douglas-fir, ponderosa pine, Engelmann spruce, subalpine fir, whitebark pine, alpine larch, cottonwoods, and aspen.

The combination of climatic, geophysical, and soil factors form the habitat types that are indicative of the ecosystem. Each habitat type represents a relatively narrow segment of environmental variation and delineates a certain potential for vegetative development (Pfister, 1977). Forests in this ecosystem rarely reach their potential climax vegetation, due to natural disturbances (e.g., fire, insects, disease, windstorms) and human-made disturbances (e.g., land clearing, timber harvest).

Humans have influenced the ecosystem through logging, livestock grazing, agriculture, introduction of exotic species, and manipulation of fire. Some of the earliest settlement in Montana occurred in the Bitterroot Valley in the 1840s; but significant effects on forest structure did not occur until the railroad arrived and mining began in Butte and Anaconda in the 1880s. By the 1890s, large parts of the Bitterroot Valley had been logged. By 1930, almost 22 percent of the area had been logged, including 40 percent of the ponderosa pine and 14 percent of other forest types. Skid trails and stumps from this era can still be found throughout the valley. About 14 percent of the National Forest System lands were affected. Only the most rugged terrain in the Bitterroot Valley, including roadless and wilderness areas, has not experienced the effects of logging (Losensky, 1993).

Since the early part of this century, humans have suppressed fires. During the past thirty years at least 25 fires have been suppressed in the project area. Four of the fires, in years 1910, 1960, 1990, and 2000, escaped initial attack efforts and reach large fire status within the project area. Lack of fire has changed forest health, composition, structure, and function. Some forest types with naturally high fire frequencies and mixed severity fire regimes, primarily ponderosa pine and Douglas-fir have been altered significantly. Other forest types have been less affected.

Increased transportation and commerce worldwide has influenced the Bitterroot Valley through the introduction of noxious weeds and other pests, such as white pine blister rust, which has had a large impact on the whitebark pine communities in the upper elevations in the Bitterroot.

Regulatory Framework

The Bitterroot NF Plan (USDA Forest Service, 1987) includes Forest-wide management goals to:

- Provide sawtimber and other wood products (including firewood for personal or commercial use) to sustain a viable local economy.
- Provide habitat for support of viable populations of native and desirable non-native wildlife.
- Seek out opportunities for biologically appropriate and cost-efficient uneven-aged management.
- Provide an economically efficient sale program.
- Apply fuels treatments and site preparation that are coordinated to minimize fire danger, insect and disease problems, and secure establishment and protection of new stands.

The Bitterroot NF Plan (USDA Forest Service, 1987) also includes Forest-wide management objectives to:

- Provide optimal habitat on elk winter range.
- Maintain vegetative diversity on land where timber production is a goal of management, and maintain sufficient old-growth habitat on suitable timberland to support viable populations of old-growth dependent species.
- Convert high-risk or insect and disease infested stands to young, healthy stands.
- Plant a variety of tree species, where habitat conditions permit, to prevent creation of monocultures that are susceptible to insects and disease epidemics.
- Harvest timber to meet timber production objectives, and design related site preparation and regeneration practices so that there is reasonable assurance that stands can be restocked within 5 years after final harvest.
- Prescribe treatments that will utilize integrated pest management strategies and treatments that reduce long-term losses due to insects and disease.
- Broadcast and under burning will be the primary method of slash treatment on slopes >40% and tractor piling and burning on slopes < 40%. Specific Forest Plan direction for Management Area 2 includes reducing activity fuels to 1-1/2 feet to provide for big game winter habitat.

Forest-wide standards, supplementing National and Regional policies, standards, and guidelines found in Forest Service manuals and handbooks, and the Northern Region Guide relevant to timber harvesting include:

- Providing well-designed timber sales to be affordable to purchasers under average market condition at the time of sale.
- Following Regional standards for tree utilization, management intensity, measurement, growth, suitability for timber production, tree openings, and silvicultural systems.
- Increasing the use of available wood fiber consistent with management objectives and economic principles.
- Implementing the principles of integrated pest management through sound silvicultural prescriptions designed to consider past, current, and potential impacts from insects and disease.
- Bitterroot NF Fire planning direction is to provide fire control measures that protect timber investments and value. Current Washington Office direction emphasizes firefighter and public safety in wildland-urban interface areas through vegetation manipulation using both mechanical and prescribed fire treatments.
- National and State Air Quality Standards for PM10 and PM2.5 will be met with all action alternatives.

Vegetation treatments using timber harvest may occur in Bitterroot NF Plan Management Areas (MAs) 1, 2, 3a, 3b, and 3c. These MAs are suitable for timber production, and include goals of managing for healthy stands of timber and optimizing timber growing potential, while optimizing forage and cover for big game on winter range (MA 1 & 2), and meeting partial retention visual quality objectives (MA 3). Complete descriptions of management area guidelines are provided in Chapter 1. The Lyman project treatment units fall within MAs 1 and 2.

The Code of Federal Regulations (CFR) is a codification of the general and permanent rules published in the Federal Register by the executive branch and departments of the federal government. The minimum specific management requirements to be met in accomplishing goals and objectives for the National Forest System are set forth in 36 CFR 219.27. Those management requirements are summarized as follows:

- Section (a) Resource Protection: Management prescriptions shall: (3) be consistent with resource values involved, and prevent long lasting hazards and damage from pest organisms, utilizing principles of integrated pest management. Under this approach all aspects of a pest-host system should be weighed to determine situation-specific prescriptions which may utilize a combination of techniques including, as appropriate, natural controls, harvesting, use of resistant species, maintenance of diversity, removal of damaged trees, and judicious use of pesticides. The basic principle in the choice of strategy is that, in the long-term, it be ecologically acceptable and compatible with the forest ecosystem and the multiple use objectives of the plan; and (5) provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives.
- Section (b) Vegetative Manipulation: Management prescriptions shall: (1) contain multiple-use goals that are consistent with Forest Plan goals and standards; (2) assure that lands treated can be adequately restocked, and (3) that lands are not chosen for greatest dollar return; (4) potential effects on residual trees and adjacent stands must be considered; (5) avoid permanent impairment of site productivity; (6) provide desired effects on all resources; and (7) be practical in terms of transportation and harvest requirements, and costs of preparation and administration.
- Section (c) Silvicultural Practices: Management prescriptions must: (1) be suitable; (2) provide allowable sale quantity; (3) provide for restocking; (4) allow cultural treatments; (5) allow for change in harvest levels; (6) provide for even-aged regeneration harvests while protecting other resources; and (7) prevent increases of forest pests.
- Section (d) Even-aged Management: (1) openings will be located to achieve the desired combination of multiple-use objectives; and (2) individual cut blocks will conform to maximum size limitations.
- Section (g) Diversity: Treatment activities designed to maintain the diversity expected in a natural forest might be modified slightly to meet the desired future condition of the area.
- 16 USC 1604 (g)(3)(F)(i) Clearcutting: Any recommended clearcutting must show that it is the optimum method to meet objectives and requirements of the Forest Plan.

The National Forest Management Act of 1976 is the basic law that governs vegetation management treatments on national forest lands. Several sections in the act, and its accompanying regulations (USDA Forest Service, 1982), specifically address terms and conditions relevant to the vegetation resource. These include sections on timber suitability, and management requirements for vegetative manipulation, including tree regeneration timeframes and Regional opening size limits.

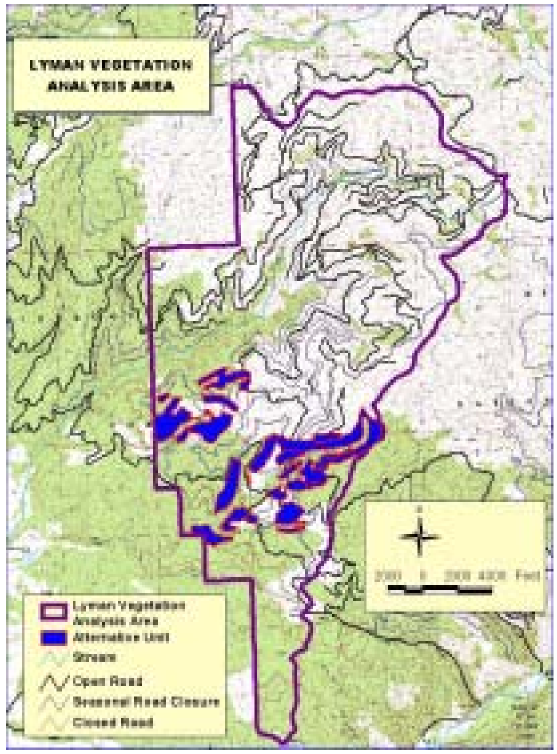
The Northern Regional Guide of 1983 provides further guidance for the development of forest plans, including: utilization standards and guidelines, management intensity, measurement of mean annual increment, biological growth potential (timber suitability), forest openings, appropriate silvicultural systems, and firewood availability guidelines (USDA Forest Service, 1983).

The Northern Region Overview sets priorities for ecosystem restoration and focuses the Forest Service Natural Resource Agenda to the National Forest lands of the Northern Region. For forest vegetation, the overview establishes indicators of risk to the proper functioning conditions of this ecosystem. Risk indicators include: (1) the loss of species composition at the cover type level, (2) the change in landscape level fragmentation, and (3) stand level structure as measured by density and seral stage/size class distribution. The overview also describes the importance of restoring ponderosa pine, western larch, and whitebark pine.

Historic Conditions

Natural resource managers increasingly rely on the "range of natural variation" or "historic condition" to develop plans that guide management within the range of ecological and evolutionary conditions appropriate for an area. This information is used to understand the past conditions and processes and provides context and guidance for managing ecological systems today and the disturbance-driven spatial and temporal variability that is a vital attribute of nearly all ecological systems. For the Interior Columbia Basin Ecosystem Management Project, Hann et al. (1997) used the last 2000 years as the appropriate temporal depth. A time period of 200 years will be used in this project and is appropriate based on studies showing the vegetation in this area was in relative equilibrium with the microclimate and native American uses during that time (Schoonmaker & Foster, 1991 as cited in Landres et al., 1999).

Within the natural variability, there are extreme or rare events that define these bounds. As managers, we recognize these extreme and rare events, however we do not manage for them. We wish to manage for the "common natural variability" that is associated with these ecosystems. This provides an ecological reference point, and gives us the ability to evaluate ecosystem change, as well as meet Forest Plan standards and socially desirable conditions (Morgan et al., 1994).



Map III-2 Lyman Vegetation Analysis Area

Vegetation Analysis Area

The Lyman vegetation analysis area is approximately 8,586 acres and is composed of Timber Stand Management Record System (TSMRS) compartment 302 and the eastern portion of compartment 301 that is bounded by the Sula State Forest to the west (see Map III-2). TSMRS compartments were used for the vegetation analysis since they are based on sub-watersheds and administrative boundary lines and the database Region 1 uses for vegetation activities and stand level information Forest.

Fire Severity

Within the analysis area BAER (Burned Area Emergency Rehabilitation) fire mapping was used to depict fire effects in terms of surface fuel consumption and soil impacts (Table 3-12). While BAER addressees the effect on soils it can be used as an indictor of impacts to vegetation. All of the areas depicted as high severity were lethal fires. In addition, some of the moderate severity burns were also lethal. Approximately half (48%) of the analysis area burned in the Bitterroot fires of 2000, a large percentage of which was lethal or stand-replacing.

Table 3- 12 BAER Fire Severity

BAER Severity	Compartment 301 (acres)	Compartment 302 (acres)	Acres
High	287	404	691
Moderate	1693	1361	3054
Low	7	697	704
Unburned	3899	238	4137
TOTAL	5886	2700	8586

Vegetation Response Units (VRUs)
VRUs are groupings of habitat types, which identify forested areas with similar fire regimes or disturbance patterns and vegetation potential, including species compositions and stand structures (Table 3-13). There are three VRUs represented by the units outlined in the alternative. A description of the three VRUs, including historic fire frequencies and intensity follows:

Figure 3- 3 Example of VRU2 with High and Moderate Severity Fire Effects (stand replacing)

Table 3- 13 Vegetation Response Units

VRU	Historic Vegetation	Historic Fuel	Historic Fire	Fire Suppression & Results
2 Warm, Dry PP and DF	Steep, dry breaklands and benches that support PP at lower elevations and DF at higher elevations. Pre-suppression composition and structure was typically open, park-like, multi-storied and multi-aged stands.	Light - surface fuels (grass, needles, twigs, branches, bark and cones). Downed woody debris of scattered large logs. Fuel loads of 1 ton/acre in open stands and up to 16 tons/acre in pole and small sawlog stands.	Fires were generally frequent and non-lethal with a relatively uniform pattern every 5 - 25 years.	Resulted in increased density, overstocking and increased fuels. Thickets of DF often occur. Increased stem density in understory and mid-canopy levels resulted in increased 2000 fire severity and effects.
3 Cool, dry and moist DF	Mid-elevation lands that lie between low elevation breaklands and high elevation stream headlands. Common tree species are DF and on moister sites, LP. PP is a minor seral species in some areas. Pre-suppression composition and structure included a mix of even and multi-aged stands of DF and/or LP. Stocking ranged from fairly open to dense.	Fuel loads average 10 – 12 tons/acre, ranges may exceed 50 tons/acre. Undergrowth and regen are usually sparse. Relatively deep duff may develop and rotten logs may be prevalent.	Fires were mixed with variable intensities ranging from frequent, low intensity, non-lethal, understory fires to infrequent, high intensity, lethal fires. Fire frequency 25-100 years.	Resulted in increased density, overstocking and increased fuels. Increased stem density in understory and mid-canopy levels resulted in increased 2000 fire severity and effects. Predisposed stands to DFB.

VRU	Historic Vegetation	Historic Fuel	Historic Fire	Fire Suppression & Results
4 Cool LP and lower AF fir	Moderate to high elevation stream headlands. Sites varied from nearly pure stands of LP to some mixed species stands of LP, DF, ES, and AF. Stands are even-aged, or where portions of the overstory survived, two-storied. Across the landscape, stand size and age classes varied from seedlings to sawtimber with all classes well represented. Stocking varied from very dense LP to moderate in some mixed species stands.	Downed woody loadings average 18-25 tons/acre typically 3 - 35 tons/acre, may reach 80 tons/acre following LP treefall after disturbance. Live fuels contribute where understories are dense. Duff layer may be very deep.	Fires were mixed with variable burn intensities ranging from periodic, low intensity, non-lethal underburns to more typical infrequent, high intensity, lethal fires with a return interval of 30 – 200 plus years	Loss of low to moderate severity fires and impacts to structure and species composition. Lack of species diversity within stands and age class diversity across the landscape. Fires of 2000 burned with lethal and mixed severity which is in the historic range and changed age/size class mosaics

(Fischer and Bradley, 1987)

The proposed treatment units discussed in Chapter 2 are characterized by VRU 2, 3, or 4 or combinations of the different types. Most of the area is VRU 3, cool, dry and moist Douglas-fir habitat types (see Table 3-13). The following table also classifies burn intensity by unit. This burn intensity rating is not based on BAER as described above, but is a site-specific burn severity rating based on direct fire effects on the main upper tree canopy of the stand. High intensity wildfire is stand replacing or lethal where 80% or more of the overstory vegetation was killed. Mixed intensity fire is described as killing between 20% and 80% of the overstory vegetation. A low intensity wildfire rating is typically an underburn, or non-lethal fire that removes less than 20% of the overstory canopy.

The units outlined in Alternatives 2 and 3 that burned with lethal fires offer opportunities for salvage harvesting fuelwood or houselogs to satisfy some local demand for these products. All of these areas are in the stand initiation stage of forest development (Oliver and Larsen, 1986).

The units that burned at low or mixed intensity are experiencing varying levels of delayed mortality as a result of cambium heating, root collar damage, loss of live crown ratio or insect damage. Species composition and structure of these stands is primarily Douglas-fir, with lesser amounts of ponderosa pine, lodgepole pine, and a trace representation of Engelmann spruce and subalpine fir.

Desired Future Condition for Vegetation
The desired future condition includes those structures, compositions, and processes that would have been present historically. It is desirable to return fire to the ecosystem and allow it to play its natural role. It is desired to maintain fuel loadings as would be expected historically by incorporating methods to restore the historic fire regime. It is desirable for insect and disease occurrence at endemic levels**.**

Desired Future Condition VRU 2
The target stand conditions include:

- A mix of successional stages ranging from grass/forb, early seral (seedling/sapling) to late seral with approximately 60% of the stand in late seral condition and 15% less than 40 years of age.
- Stocking levels between 40 – 80 square feet of basal area per acre.
- Where regeneration is desired in openings created from either harvesting or mortality, stocking levels of 75 - 150 trees per acre of ponderosa pine is desired 5 – 10 years following disturbance or harvest.
- Improve the overall health of the stands by restoring the species mixture to 70 - 85% ponderosa pine and 15 - 30% Douglas-fir.
- Improve the overall productivity of the stands by reducing competition and creating more growing space.
- Reduce total fuel load to 10-15 tons in units with moderate/high severity burns and 5-10 tons in low severity burns or wildland-urban interface (WUI) units. The residual fuels exceed 4" diameter and include coarse woody debris (CWD) and snags.

Desired Future Condition VRU 3
The target stand conditions include:

- A mix of successional stages ranging from early seral (seedling/sapling) to late seral with patch sizes varying between ten and several hundred acres.
- Reduce stocking levels by reducing stand densities to between 80 – 100 square feet of basal area per acre.
- Where regeneration is necessary due to the amount of mortality, stocking at 200 trees per acre of Douglas-fir and lodgepole pine is desired 5 years following the fires or the final harvest.
- Species mixture should include 80 - 90% Douglas-fir and lodgepole and 10 - 20% other species such as subalpine fir and Engelmann spruce.
- Improve the overall productivity of the stands by reducing competition and creating more growing space.
- Reduce total fuel load to 20-30 tons in units with moderate/high severity burns, 20-25 tons in low severity burns and 15-20 tons in WUI units. The residual fuels will exceed 4" diameter and include CWD and snags.

Table 3- 14 Unit VRU/Fire Intensity

Unit	VRU	Fire Intensity
1	3	Low
2	3	High
3	4	Mixed
4	2	High
5	3/4	High
6	3	Low
7	4	High
8	4	Low
9	3	Low
10	4	High
11	2	Low
12	2	Low
13	2	Low
14	2	Mixed
15	3	Low

Desired Future Condition VRU 4
The desired future conditions are similar to the reference condition, but with more seral species in various stages and lower densities. The creation of age and size class landscape mosaics to prevent landscape level mountain pine beetle epidemics or stand-replacement fire events are socially desirable. Reduce total fuel load to 25-30 tons in units with low, moderate, or high severity burns and 15-20 tons in WUI units. The residual fuels exceed 4" diameter and include CWD and snags.

Large patches of shade intolerant species with large patches of structural diversity across the landscape are desired. This would include a large component of standing dead; both fire-killed and insect and disease associated mortality. Burns would typically be associated with timber harvest or prescribed fire. Fire and harvest would be used to replace reference condition fires by breaking up successional stage (i.e., discourage having the whole area as one successional stage because it leads to massive sudden changes). Insects and diseases at endemic levels are desired.

Douglas-fir Bark Beetle (DFB)

Prior to the fires of 2000, the BNF was experiencing a DFB epidemic on the south half of the Forest. An epidemic occurs when mortality reaches one tree or more per acre of host type per year (Gibson, 2001). A detailed discussion of DFB can be found in the "Bitterroot Fires 2000, An Assessment of Post-Fire Conditions with Recovery Recommendations" and the "Burned Area Recovery FEIS, 2001." In 2002, DFB populations soared to the highest infestation level ever recorded on the BNF with approximately 55,000 acres infested Forest-wide. Approximately 12,000 acres are on the Sula Ranger District (Gibson, 2003).

Fire suppression for the last 50 years was extremely influential in leading to the BNF pre-fire DFB epidemic. Fire exclusion left much of our forest communities with different vegetation composition, structures, and fuel accumulations than may have been present historically (Fischer and Bradley, 1987). Prior to the fires of 2000, much of the landscape across the BNF was dominated by dense, multi-storied structures with a high composition of DF. This changed forest structure and composition condition coupled with the effect of the 2000 fires, resulted in continuation of the DFB epidemic we are experiencing on the Forest and in the analysis area today. A positive correlation has been identified between fire-damaged trees and DFB populations in the past decade as beetles take advantage of weakened trees.

In 2002, beetle activity within the analysis area affected low and moderate severity burned areas. Within these areas, where infestations are extensive, trees as small as 8-10"dbh have been infested. Furthermore, in 2003, where DFB populations are high, beetle activity has spread to green, unburned host trees. However, outside DFB epicenters, in areas characterized by light, cool underburns or in unburned stands, larger diameter trees (generally 14" dbh or larger) are the preferred DFB hosts, which is typical of the species. Presently, significant to extensive DFB infestation is occurring within all of the units with suitable host material.

Other Pathogens

In some areas, light to moderate dwarf mistletoe and root rot infection is evident. Dwarf mistletoe infection spreads to uninfected trees and causes reduced tree vigor and growth. Preliminary data indicate mountain pine beetle (MPB) populations are on the rise following the fires of 2000. Some MPB activity is occurring in lodgepole pine within the proposed treatment units. It is apparent that some high-risk areas are present. Where infestation occurs those trees would be removed.

DFB Hazard Rating

To assess current DFB hazard and risk within the analysis area, the Bitterroot National Forest utilized the *Douglas-fir Beetle Hazard Rating System Using the Oracle Database and the Forest Service IBM Platform* developed on the Idaho Panhandle National Forest by Randall and Tensmeyer (1999). The hazard rating system incorporates stand characteristics that are known factors contributing to increased risk of attack from DFB. The hazard rating system is based on stand summary information housed in the Forest Service Region 1 TSMRS Oracle database (Randall and Tensmeyer, 1999).

DFB hazard is defined as the ability of a stand to support DFB populations. Factors including increased tree size, age, stand basal area (BA), and fire scorch increase stand susceptibility to attack and provide the most suitable breeding material for DFB populations. Generally, the larger, older, and more stressed a Douglas-fir tree is the more desirable it is to beetles seeking host material. The greater the density of large Douglas-fir trees within stand, the more likely it is to support significant DFB populations. The hazard rating system developed on the Idaho Panhandle National Forest uses a step-wise progression to determine DFB hazard (Project File-Silv-1).

Table 3- 15 Douglas-fir Beetle Hazard Rating

DFB Hazard Rating	Compartment 301	Compartment 302	Acres
High	0	184	184
Moderate	159	311	470
Low	1602	1177	2779
No Data	4125	1028	5153
TOTAL	5886	2700	8586

Surveys conducted during the field season of 2002 found populations occurring within many of the units in the action alternatives. The populations were not limited to the moist habitat types (VRU 3 & 4). The warm/dry sites in VRU 2 (and sometimes VRU 3) also have evidence of beetle attack. In both cases, it is obvious that these attack sites are a result of epidemic level DFB populations, stand BA, tree size, and stand age coupled with stress caused by the fires of 2000. All stands containing a significant amount of live Douglas-fir were analyzed to determine their hazard/risk rating in this analysis area. Stands with known DFB activity and significant hazard and risk are listed in Table 3-16.

Table 3- 16 Unit Douglas-fir Beetle Hazard Rating

Unit	Stand BA	% BA DF	Average DF dbh	Average DF Age	DFB Hazard Rating
1	105	76	12.5”	178	Moderate
6	114	94	15.4”	219	Moderate
9	164	77	14.3”	201	High
11	81	56	13.6”	163	Moderate
12	102	87	14.4”	207	Moderate
13	112	82	15.0”	214	Moderate
14	121	85	11.0”	177	Moderate
15	154	81	18.8”	184	High

Field surveys conducted in 2003, following the DFB flight in the spring, showed extensive evidence in current year’s mortality in Units 6, 9, and 12. DFB losses are also continuing in Units 1, 11, 13, 14 and 15. In severe epidemic conditions as are present within the analysis area stands with moderate to high hazard are high risk for infestation (Gibson, 2003).

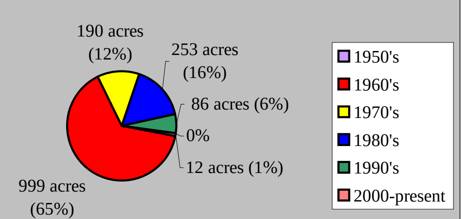
The extensive level of DFB mortality within the Lyman units present today is not a static phenomenon. As long as suitable host material is present and population levels are high within the stands the mortality trend is likely to continue. Successfully attacked Douglas-fir trees often take an entire year to exhibit crown symptoms by turning pale green, yellow, orange, red, or brown as a result of beetle infestation. However, effective cambial girdling occurred far earlier at which time the trees were imminently dead. For this reason, imminent tree mortality in trees with green crowns will be assessed at the time of marking and continue throughout the duration of the sale. On seemingly healthy trees when foliage has not turned, frass found on over 50% of the bole of the tree will usually indicate a successful attack and tree should be considered imminently dead. Douglas-fir beetles tend to attack in the upper portion of the tree and are hard to see. Thus, when attacks are seen at the base or at DBH; it is an indication of more hits higher up in the tree and may be enough hits to consider tree as a dying tree. On Douglas-fir trees with other contributing factors including, but not limited to, root rot, stem decay, fire damage, mistletoe infestation, or poor live crown ratio, frass found on over 30% of the bole of the tree will be considered imminently dead. A site-specific determination will be made to verify when a Douglas-fir can be considered dying outside of these guidelines.

Stand Development and Past Management History

Nationally, 73% of the 191 million acres of National Forest System lands are considered forested. Of those forested lands, 35% is available for timber harvest and are being harvested at a rate of about 0.5% per year. Sixty-five percent of the forested land is designated for non-timber uses (USFS, 1997).

Within the Lyman vegetation analysis area, nearly all of the area is considered suitable for timber management (Forest Plan MAs 1, 2, 3a, and 3c). Approximately 64% of the area is MA 1, timber emphasis the remaining portion, 36% is MA 2, winter range.

Figure 3.4
Regeneration Harvest By Decade



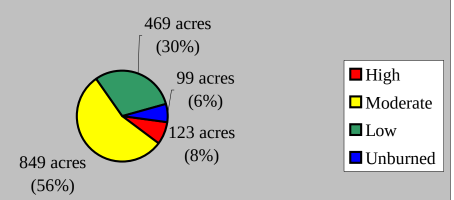
Within the analysis area, 1540 acres (18%) have been regenerated with a clearcut, shelterwood, or seedtree reproduction method. Most of these activities occurred in the 1960s and terracing was used as a site preparation method (see Figure 3.4). Many of these areas are located within VRUs 2 and 3. Of the plantations in the analysis area, 1441 acres (94%) burned with varying intensities in the fires of 2000 (see Figure 3.5). Of the 1441 acres that burned, 64 acres is high priority for planting and an additional 60 acres were planted in the fall of 2002. Within the vegetation analysis area, 7 acres have been harvested (Guide Timber Sale) in conjunction with the BAR FEIS and ROD. This portion of the area may require planting depending on the level of DFB mortality and removal within the unit.

In addition, 4898 acres (57%) of the Lyman vegetation analysis area was affected by the Sleeping Child burn in 1961, a 51,000 acre stand-replacing disturbance. The landscape mosaic created by the Sleeping child burn, in combination with diminished winds, stopped the eastern advance of a crown fire run during the 2000 wildfires. The entire northeast portion of the analysis area is characterized by predominantly lodgepole pine sapling to pole-size stands.

Regeneration

It is Forest Service policy to assure lands can be restocked within 5 years of final harvest on lands being managed for timber production (FSM 2470.3). Appropriate site-specific stocking trajectories for "target stand" or desired stand conditions must be met. Stands that meet this stocking level by year 5 or are progressing along that trajectory are considered satisfactorily stocked relative to the NFMA standard. These stands are either progressing toward certification with natural regeneration or planted trees, or a combination, or have been certified as a completed reforestation project, with no further reforestation investments necessary.

Figure 3.5
Regeneration Harvests Burned
2000 BAER Fire Severity



Natural regeneration to desired stocking levels and with desired species may occur on north, northeast, and northwest aspects above 5800 feet in elevation in subalpine fir habitat types (VRU 4). However, natural regeneration in lower VRUs could be hindered by a lack of seed sources, particularly for ponderosa pine and in some areas Douglas-fir.

Trying to maintain or enhance ponderosa pine in VRU 2 may be problematic because of the lack of seed. Stands may require interplanting or full planting depending on the intensity of the fire. Due to the fire intensity, the historic structure and function of these habitats in this VRU have been significantly altered and seed sources destroyed. Successful natural regeneration may take as long as 80-100 years on dry pine sites following large scale disturbance (Oliver and Larsen, 1996).

Natural regeneration is possible on some VRU 3 site. Planting may be necessary to provide species diversity and desired stocking levels. Natural regeneration is possible on most VRU 4 sites, as evidenced by the Sleeping Child burn.

Environmental Consequences

<u>Effects Common To Action Alternatives</u>

Long-Term Site Productivity

Long-term site productivity would be maintained as required by 36 CFR 219.27 (b)(5) by retaining existing down woody material, recruiting additional down woody material, and minimizing soil compaction by using skyline yarding systems, and implementing mitigations which restrict equipment to certain conditions. Existing coarse woody debris would be retained in untreated stands. Stands with regeneration harvests would have additional coarse woody debris retained on the site, so that post-site preparation activities would leave the recommended amount of coarse woody debris for long-term site productivity.

Ecosystem Management
All treatments are designed to produce conditions that meet Forest Plan goals and standards using ecosystem management principles. Ecosystem management is defined here as "an ecological approach to achieve the multiple use management of the National Forest and grasslands" (Robertson, 1992). An ecological approach includes specifying ecosystem elements thought to be necessary to allow ecosystems to function within their historic range of variability. Elements can be seen at the stand level (e.g., specifying both live and dead retention trees, coarse woody debris, understory vegetation conditions, and successional conditions) or at the landscape level. The action alternatives have been designed using these concepts. Treatments are designed to mimic natural vegetation conditions within their historic range of variability.

Regeneration Harvest and Opening Size
It is Forest Service policy to prescribe a regeneration harvest when a salvage entry will begin the regeneration of even-aged stands, FSM 2471.31. Each of alternatives will result in stand conditions suitable for forest regeneration to approximately the same levels. Forest Service policy is to normally limit the size of harvest openings created by even-aged silviculture systems in the Northern Region to 40 acres or less. However, where catastrophic events such as fire, windstorms, or insect and disease attacks have occurred 40 acres may be exceeded (FSM 2471.1). All three alternatives will result in regeneration openings larger than 40 acres due to the effects of wildfire and insects. Regeneration harvest activities would occur in forest stands where fire and insect induced mortality has led to or contributed to high mortality within the stand. Fuels reduction, followed by planting of early seral species might also occur. The extensive mortality in some units will result in even-aged silvicultural regeneration methods. Regeneration silvicultural systems would be applied to the units specified as salvage/regeneration as appropriate. Each treatment is supported by a silvicultural diagnosis and a detailed prescription will be written or reviewed by a Certified Silviculturist. In addition, no action alternative will result in openings consistent with the levels outlined in Alternative 2 and 3 due to extensive mortality within the stands.

Within the vegetation analysis area, adjacent stands are in various levels of post-fire recovery. Previously managed stands in need of reforestation treatments within the analysis area that experienced high levels of mortality from the fires of 2000 either have been planted or are scheduled for planting at this time.

Compliance with NFMA and Forest Plan to restock areas of even-aged harvest within 5 years
Assurance is given that all stands outlined in the alternatives can be adequately restocked within five years of final harvest. This conclusion is based on experience and past harvest regeneration reports within TSMRS compartments 301 and 302, where 100% regeneration success has occurred within five years for regeneration cut stands since 1976 (TSMRS regeneration status reports are contained within the project file).

Treatments affecting insect infestation
Red turpentine beetle, Ips or pine engraver, mountain pine beetle, and western pine beetle are all occurring at endemic levels in VRU 2, 3 and 4. Beetle activity is present within the units outlined in the action alternatives and Douglas-fir bark beetles are occurring at epidemic levels. It is possible that beetle activity may be present within the units even after treatments are completed; however, it is likely that local population levels within the units will decline as a result of treatments proposed because some beetle brood would be removed from the area. Treatments are actually designed in all action alternatives to remove infested trees and thus, free up growing space by reducing competition for sunlight, water, and nutrients.

Treatments affecting disease outbreaks
A typical disease in VRU 2 and 3 is root rot. Some evidence of *Armillaria ostoyae* ([Romag.] Herink) is also present in the analysis area. Douglas-fir is quite susceptible to *Armillaria.* Restoring ponderosa pine to sites historically occupied by the species will reduce future mortality from *Armillaria* (USDA, 1996). In addition, establishing a lodgepole pine seral component in VRU 3 and 4 will also reduce long term effects from *Armillaria.*

Dwarf mistletoe (*Arceuthobium douglasii*), present in Douglas-fir, is also present within the treatment areas. Dwarf mistletoe is not known to directly kill trees within a short period of time. However, it does predispose trees to bark beetles that can kill them. This is because these diseases weaken trees causing them to lose their vigor. Targeting the removal of trees infected with dwarf mistletoe will also reduce the amount of infection within the stand and ongoing infection of regeneration. Sanitation cutting to remove heavily infested trees would occur on three units. The highest infection level is in Unit 9 and occurs in one or two isolated pockets, not throughout the unit. An estimated 5 to 8 acres are infected and trees with a Hawksworth rating (USDA, 1977) of 4-6 (moderate to heavy infection) would be removed to protect the regeneration from infection. It is possible that a one to two acre opening would result in the most heavily infected area within Unit 9. In Units 6 and 11, approximately five acres are infected in each. The infection level is not as high as in Unit 9, and no openings are anticipated. The infection in Unit 6 is moderate, but more dispersed through the unit than the clump in Unit 9 and would result in a slight reduction in canopy cover. Unit 11 is the least infected and has a much greater species composition of ponderosa pine. The infection level is similar to Unit 6. Removal of the Douglas fir trees that are moderately to heavily infected with dwarf mistletoe would greatly reduce the incidence of this pathogen in the newly established tree regeneration, resulting in much healthier stands in the future.

Meeting the Desired Future Condition & Reasonable Foreseeable Actions
Each action alternative includes treatments that work toward achieving the desired future condition. Each is silviculturally sound; however, the two action alternatives differ in the amount of area treated. Both create canopy gaps or set back stand conditions to early seral by removing dead trees and imminent mortality and provide conditions conducive to regeneration and move stands toward the desired condition. As mentioned in the desired condition section previously, this is not a static state or structurally/compositionally one specific condition. The desired condition is a mosaic of many vegetation components that vary across the stand and landscape level.

In general, Alternative 2 and 3 move stands along the trajectory towards the desired future condition by removing dead and dying trees, sanitation of dwarf mistletoe, and establishment of young more resilient stands. Alternative 1 does not further stands towards the desired future condition since it retains all dead trees onsite, does not reduce fuel loading and does not assure regeneration of desired species consistent with historic stocking levels and species composition.

Direct and Indirect Effects

For this section, the effects will be described for a set of units rather than for each individual unit. This is done to reduce the redundancy in describing effects for units having similar existing conditions as well as effects. The unit groupings are based on stand characteristics, VRU, and burn severity.

The following items will be addressed for each alternative:

- Effects of DFB on stands
- Regeneration
- Restoration of historic structure, species composition, and function

Table 3- 17 Stand Grouping Characteristics

Stand Grouping Characteristics	Units
Warm, dry PP and DF, VRU 2 low severity	11, 12, 13
Warm, dry PP and DF, VRU 2 mixed to high severity	4, 14
Cool, dry and moist DF, VRU 3 low severity	1, 6, 9, 15
Cool LP and lower AF fir, VRU 4 low severity	8
Cool LP and lower AF fir, VRU 4 mixed to high severity	2, 3, 5, 7, 10

Warm, Dry PP and DF with low burn severity (Units 11, 12, 13)

The pre-fire condition of this group of units was a mix of PP and DF. These Lyman units are characterized by increased composition and density of DF. Thickets of DF, increased stem density in understory and mid-canopy levels resulted in increased 2000 fire severity and effects. PP is more prevalent on southern and westerly aspect, with a greater percentage of DF on north aspect. Some mature PP remnants survived the effects of the fires; however, adequate seed sources are absent. In addition, suitable DFB hosts are heavily infested with bark beetles within these units.

Alternative 1 No Action

- Live basal area reduction 30%-90% as a result of DFB induced mortality and fire effects

- Forest openings created as a result of DFB induced mortality and fire effects and sustained as openings longer than where reforestation treatments occur
- Poor PP regeneration due to limited seed source
- Conditions favorable for eventual DF regeneration and ultimate dominance
- Spread of Douglas-fir mistletoe infecting regeneration
- Suppressed, unfavorable, unhealthy trees remain in stand reducing stand productivity and perpetuating dysgenic stands
- Fuel loading levels heavy following extensive fire and DFB mortality
- Regeneration not assured and at risk due to heavy fuel loading
- Further loss of PP forest types

Alternative 2 & Alternative 3

- Live basal area reduction 30%-90% as a result of DFB induced mortality and fire effects.
- Forest openings and conditions conductive to forest regeneration created
- Shift in species composition restoring stands more dominant of PP over DF through planting
- Treatment and reduction of DF mistletoe in stand and removal of poor quality, suppressed, dysgenic trees
- Fuel loading reduced
- Planting and stand establishment consistent with historic and DFC densities
- Regeneration assured and risk from fire loss reduced by fuel load reductions

Differences Between Alternative 2 And 3

⇒ Alternative 2: Reduce fuels, weed and ensure regeneration on 40 acres in Unit 13.
⇒ Alternative 3: Reduce fuels, weed, and ensuring regeneration of 33 acres of Unit 13.

Warm, dry PP and DF, VRU 2 mixed to high severity (Units 4, 14)

The prefire condition of Units 4 and 14 was a mix of PP and DF. The increased composition and density of Douglas-fir through the canopy layers fueled intense fire behavior and severity. Less that 10% of these stands survived the fires of 2000. The remaining live trees include both PP and DF.

Figure 3-6 Unit 4

Alternative 1 No Action

- Forest openings created due to fire and DFB and sustained as openings longer than where reforestation treatments occur
- Poor PP regeneration due to limited seed source
- Sporadic DF regeneration probable
- Conditions favorable for DF dominance
- Existing fuel loading remains on site
- Regeneration not assured and at risk due to fuel loading
- Further loss of PP forest types

Alternative 2 & Alternative 3

- Forest openings and conditions conductive to forest regeneration

- Shift in species composition restoring stands more dominant of PP over DF through planting
- Fuel loading reduced
- Planting and stand establishment consistent with historic and DFC densities
- Regeneration assured and risk from fire loss reduced by fuel load reductions

<u>Differences Between Alternative 2 And 3</u>

- ⇒ Alternative 2: Reduce fuels and ensure regeneration on 122 acres in Unit 4.
- ⇒ Alternative 3: Reduce fuels ensure regeneration on 64 acres in Unit 4. No treatment east of FDR 73168.

Cool, dry and moist DF, VRU 3 low severity (Units 1, 6, 9, 15)

This group of units is characterized by predominantly old, dense DF stands that did not experience direct mortality as a result of the 2000 fires, but are experiencing high levels of DFB mortality since their stand structure, and composition coupled with the stress of the fires and ongoing DFB presence has resulted in extensive tree mortality.

Alternative 1 No Action

- Live basal area reduction 30%-95% as a result of DFB induced mortality and fire effects
- Forest openings created due to and sustained as openings longer than where reforestation treatments occur
- Uncertain regeneration success
- Spread of Douglas-fir mistletoe infecting regeneration
- Suppressed, unfavorable, unhealthy trees remain in stand reducing stand productivity and perpetuating dysgenic stands
- Fuel loading levels heavy following extensive DFB mortality and not reduced
- Regeneration not assured and at risk due to fuel loading
- Continued stand deterioration and DFB mortality

Alternative 2 & Alternative 3

- Live basal area reduction 30%-90% as a result of DFB induced mortality and fire effects
- Forest openings and conditions conducive to forest regeneration created
- Reduction of DF mistletoe in stand
- Removal of suppressed, unfavorable, unhealthy trees to improve overall stand health and enhance regeneration success
- Fuel loading reduced
- Planting and stand establishment consistent with historic and DFC densities and species composition to include a mix of DF, LP and PP
- Regeneration assured and risk from fire loss reduced by fuel load reductions

<u>Differences Between Alternative 2 And 3</u>

- ⇒ Alternative 2: No treatment of Unit 15.
- ⇒ Alternative 3: Reduce fuels, weed and ensure regeneration in Unit 15.

Cool LP and lower AF fir, VRU 4 low severity (Unit 8)

This unit experienced low levels of mortality and the condition is consistent with historic species composition, structure and function. Maintaining patches of shade intolerant species with a structurally diverse age class mosaic across the landscape is desired.

Comment:

Alternative 1 & Alternative 3

- Live basal area reduction 5%-40% as a result of MPB and DFB and fire induced mortality
- Canopy holes created that are quickly occupied by existing cohort

- Some increases in fuel loading, but consistent with historic conditions
- Additional course woody debris and snags
- No marked change in existing multli-layered and mixed species compositions
- Gradual shift from shade intolerant species such as lodgepole pine to more shade tolerant DF and AF

Alternative 2

- Live basal area reduction 5%-40%as a result of MPB and DFB and fire induced mortality
- Canopy holes created, some quickly occupied by existing cohort, more disturbance provides opportunity for some LP pine seedling recruitment
- Reduction in fuel loading
- Some stand holes set back to early seral conditions and regeneration assured on these sites

Cool LP and lower AF fir, VRU 4 mixed to high severity (Units 2, 3, 5, 7, 10)

This group of units had stand replacing wildfire that is consistent with historic disturbance patterns in this forest type. The desired future condition is to establish stands with predominantly shade intolerant species at lower densities than pre-fire conditions.

Alternative 1 &Alternative 3

- Existing forest openings as a result of mortality
- Excellent to patchy natural regeneration
- Regeneration species composition favoring LP and DF
- Fuel loading moderate to heavy, but consistent with historic conditions
- Regeneration not assured and at risk due to fuel loading

Differences Between Alternative 1 And 3

- ⇒ Alternative 1: No treatment of Unit 2 and 3.
- ⇒ Alternative 3: Reduce fuels and ensuring regeneration of Unit 2, 7 acres, and Unit 3, 19 acres.

Alternative 2

- Existing forest openings as a result of mortality
- Forest openings and conditions conductive to forest regeneration created
- Early seral LP establishment though natural regeneration and planting to ensure success
- Fuel loading reduced
- Planting and stand establishment consistent with historic and DFC densities and species composition
- Regeneration assured and risk from fire loss reduced by fuel load reductions

Cumulative Effects

The past, present and reasonably foreseeable actions were considered to determine the potential for cumulative effects on sustainable forest conditions. The vegetation analysis area was used for the cumulative effects analysis area since it represents a sub-watershed and provides a landscape approach to analysis. The cumulative effects analysis summary is found in Table 3-18. Alternatives 2 and 3 do not differ in respect to cumulative effects on the forest resource. Only past, present and reasonably foreseeable future activities within the analysis area that are pertinent to the forest resource will be addressed in the cumulative effects within this section. In addition, recent harvest activities on adjacent state lands will be addressed.

Table 3- 18 Cumulative Effects Summary for Forested Resource

Project/Activity	Cumulative Effect in Conjunction With Project
Past FS Timber Sales	Past timber sales within the analysis area created openings that are generally sapling to pole sized stands at present. Alternative 2 and 3 of the project remove dead, dying, diseased, and dysgenic trees to free growing space for remaining individuals or provide conditions conducive to planting and assure regeneration. Alternative 2 and 3 will result in a mosaic of age and size classes by leaving healthy individuals and establishing seedlings. Alternative 1 will create the same mosaic except it does not assure seedling establishment.
State Salvage Sales	Removal of salvage material on adjacent state lands created early seral forest openings immediately adjacent to the project area; however, since State sales removed dead and dying trees forested openings were present prior to the entry. The State reduced fuel loading immediately adjacent to some of the Lyman units that will reduce fuel hazard to regeneration. Alternatives 2 and 3 further reduce fuels in the area and assure regeneration. Alternative 1 will not reduce fuel loading and provides no regeneration assurance.
Planting	Project helps speed recovery of stands from impacts of fires and insect induced mortality through regeneration assurance cumulatively with ongoing planting activities in the area. Alternative 1 is less likely to speed and aid recovery of stands with no assurance of new stand establishment and regeneration success and more forested openings retained longer across the landscape.
Fire Effects	The fire effects were established for the forest resource in the existing condition section of this document. The effects of the fire with respect to the forested resource entails continued mortality due to physiological stress from the fire, insect attack, and regeneration conditions. Alternative 2 and 3 ameliorate these effects by removing dead and dying material and assuring regeneration. Alternative 1 does not remove any mortality as a result of the fire effects and does not assure regeneration.
Firewood Cutting	The effects of continued firewood cutting would remove additional fuels along open roads within the analysis area and potentially provide a small benefit by reducing fuel loading hazards and utilizing mortality following treatment under alternative 2 or 3. Firewood cutting would provide some small benefit by removing some fuel loading along open roads if Alternative 1 were selected.
DFB Infestation	Presently approximately 12,000 acres are infested with DFB on the Sula Ranger District. Alternatives 2 and 3 would remove DFB infested trees. Some insects may be removed form the forest by removing material before they emerge from trees. In addition, opening up stands and reducing competition through basal area reduction within stands may reduce the likelihood of DFB attack in remaining DF trees within stands. Alternative 1 does not address DFB infestation and continued extensive mortality is anticipated for the next few years.
Guide Timber Sale	Removal of salvage material from the Guide Timber Sale treated 7 acres within the analysis area. The sale removed dead and dying trees; therefore, forested openings were not created by the sale entry. Fuel loading was reduced within the Guide Timber Sale that will reduce fuel hazard to regeneration in adjacent lands. Where warranted planting will occur within the Guide Timber Sale. Alternatives 2 and 3 assure regeneration and expedite forest recovery following fire and insect induced mortality. Alternative 1 does not reduce fuels or provide regeneration assurance.
Grazing in East Fork Allotment	Livestock use may occur within some of the openings created within the Lyman units that are within the grazing allotment; however, due to poor forage, steep slopes, and no water sources, the area would only receive light usage as transitory range as the units are generally considered unsuitable rangeland. Riparian areas are not proposed for harvest so deadfall would discourage any sustained livestock use. Alternative 1 would provide less opportunity for use by livestock than Alternatives 2 or 3.

Summary
Addressing the effects of DFB on stand, assuring regeneration, and moving stands along the trajectory to restore historic structure, species composition, and function is accomplished by all action alternatives. Assuring regeneration of ponderosa pine within VRU 2 in essential component of the desired future condition. The potential for natural regeneration of PP is low since the seed source is very limited in mature stands that burned at high severities. Arno and others (1985) suggests that ponderosa pine seldom regenerates adequately without planting after a stand-replacement fire. Ponderosa pine seed is not easily disseminated over a large area due to its large size and heavy weight (Burns, 1990). Furthermore, reducing fuel loading would be accomplished by alternatives 2 and 3 and this will reduce fuel hazards to regenerating stands. DFB infestation levels may also drop after the infested material is removed and stand density reduced if one of the action alternatives is selected.

Forest Plan Consistency
Alternative 2 and 3 meets the following Forest-wide goals, objectives and standards; Alternative 1 would not accomplish them and is not consistent with the Forest Plan:

- Provide sawtimber and other wood products to the local economy
- Apply fuel treatments and site preparation that are coordinated to minimize fire danger, insect and disease problems, and ensure establishment and protection of new stands.
- Convert high-risk or insect and disease infested stands to young, healthy stands,
- Plant a variety a variety of tree species, where habitat conditions permit, to prevent creation of monocultures that are susceptible to insect and disease epidemics.
- Harvest timber to meet timber production objectives, and design related site preparation and regeneration practices so that there is reasonable assurance that stands can be restocked within 5 years after final harvest.
- Prescribe treatments that will…reduce-long term losses to insects and disease.

THREATENED, ENDANGERED, AND SENSITIVE PLANTS SPECIES AND NOXIOUS WEEDS

Introduction
An evaluation of threatened, endangered, and sensitive plant species for the Lyman Salvage Project was conducted in order to determine species most likely to be affected by proposed activities. The Montana Natural Heritage Program database and Bitterroot National Forest records were reviewed to identify known sensitive plant populations in or near the proposed sale area. Aerial photographs were used to determine potential habitat for sensitive plant species and noxious weeds in the project area. Based on this data, a list was compiled of sensitive plant species that either were known to occur within the project area or had the potential to occur in the area based on suitable habitat (see Table 3-19, below). The Forest Geographic Information System (GIS) database was then reviewed for previous surveys completed in the area before conducting field surveys. Any areas not previously surveyed were field checked in June 2003 by Bitterroot Forest field botanists.

Regulatory Framework
The Endangered Species Act requires that the Forest Service conserve endangered and threatened species. The National Forest Management Act and Forest Service policy direct that National Forests be managed to maintain populations of all existing native pant and animal species at or above minimum population levels. A minimum viable population consists of the number of individuals adequately disturbed throughout their range necessary to perpetuate the existence of the species in natural, genetically stable, self-sustaining populations. Plant species, for which population viability is a concern are identified by the Forest Service as sensitive species. This category may include federal candidates (plants being studied by the U.S. Fish and Wildlife Service for proposed listing as threatened ore endangered status), or plant species proposed for listing as threatened or endangered in the Federal Register (Lesica and Shelly 1991). Forest Service policy requires that activities conducted on National Forest lands be reviewed for possible impacts on endangered, threatened or sensitive species (USDA Forest Service1992).

Three federally listed threatened plant species occur in Montana: water howellia (*Howellia aquatilis*), Spalding's catchfly (*Silene spaldingii*), and Ute ladies' tresses (*Spiranthes diluvialis*). None of these species have been found on the Bitterroot National Forest. The Northern Region Sensitive Plant Species List (USDA Forest Service1999) identifies a number of plants for each National Forest for which population viability is a concern. This list includes 32 vascular and three non-vascular plant species on the Bitterroot National Forest.

Area of Analysis

The area analyzed for sensitive plants and noxious weeds includes the area of proposed activities for Alternative 2, taking into consideration known sensitive plant populations within five miles of the analysis area.

Effects Analysis Methods

The effects of proposed management activities on sensitive plant species were assessed by evaluating impacts to population numbers, habitat and population viability of these species at several geographic scales: 1) global range; 2) statewide range; 3) on the Bitterroot National Forest and; 4) within the project area.

There were no sensitive plants found in the Lyman Salvage Sale area during surveys conducted in June 2003 by Bitterroot Forest field botanists. Potentially suitable habitat does exist for turkey-peas, hollyleaf clover, woolly-head clover, Rocky Mountain paintbrush and Lemhi penstemon.

Noxious weeds are scattered throughout the project area. Spotted knapweed *(Centaurea biebersteinii {C. maculosa}*) is most prevalent along the roads and in open areas in previously entered units. Houndstongue *(Cynoglossum officinale)* is also present in Units 4, 5, 9, 11, and 14, as well as scattered plants along the roads. Canada thistle *(Cirsium arvense)* is found in Units 1, 4, and 9; tall buttercup in Unit 9; and St. John's wort *(Hypericum perforatum)* is found in Unit 13.

An evaluation of the potential risk of spread of noxious weeds in the Lyman analysis area was accomplished by methodology outlined in Losensky's (1987), *An Evaluation of Noxious Weeds on the Lolo, Bitterroot, and Flathead National Forests.* This model bases risk on habitat type, aspect, and soil type. Generally, removal of the tree canopy and disturbance of the soil increases the risk of invasion. Spotted knapweed is particularly responsive to these types of disturbances.

Existing Condition – TES Plants

The following species have potential habitat in the project area and/or occur in the project area vicinity.

Table 3- 19 Sensitive Plant Species that Have Potential to Occur in the Project Area

Dwarf onion	*Allium parvum*
Candystick	*Allotropa virgata*
Rocky Mountain paintbrush	*Castilleja covilleana*
Yellow lady's slipper	*Cypripedium parviflorum*
Giant helleborine	*Epipactus gigantea*
Western boneset	*Eupatorium occidentale*
Turkey-peas	*Orogenia fusiformis*
Lemhi penstemon	*Penstemon lemhiensis*
Woolly-head clover	*Trifolium eriocephalum*
Hollyleaf clover	*Trifolium gymnocarpon*
California false hellebore	*Veratrum californicum*

On the Bitterroot National Forest candystick occurs in mature lodgepole pine forests with an open understory. Several candystick populations are known in the East Fork area. Candystick is a mycotrophic species that obtains its energy from conifers through a soil fungus. Post-fire monitoring of candystick populations in the Tolan Creek drainage revealed that where fires killed the forest canopy, candystick plants also died. Patches of possible candystick habitat that previously existed in the Lyman project area burned in the 2000 fires destroying suitable candystick habitat until mature lodgepole trees are once again available.

Western boneset has been found east and south of the project area, where it grows in talus and on rock outcrops and cliffs. Habitat for this species does not occur in the project area.

Yellow lady's slipper, giant helleborine, and California false hellebore are restricted to riparian habitats. Yellow lady's slipper has not been found on the Bitterroot National Forest, although is known from adjacent forests and is expected to occur here. Giant helleborine was recently discovered on the West Fork Ranger District. California false hellebore is reported from the southern Sapphire Range. Riparian habitats occur in several of the proposed units. Logging activity avoids riparian areas to protect water quality, so habitat for yellow lady's slipper, giant helleborine, and California false hellebore should not be affected.

Dwarf onion and Lemhi penstemon occur in the project area vicinity in grasslands, often with scattered ponderosa pine and Douglas-fir. They are usually found in microsites with naturally bare soil and few competing plants. Patches of possible habitat for dwarf onion and Lemhi penstemon occur in Units 11 and 13.

Rocky Mountain paintbrush, turkey-peas, woolly-head clover, and hollyleaf clover occur in mid-elevation forests on the Bitterroot National Forest. The proposed units contain possible habitat for these species.

Sensitive plant surveys were done in portions of Units 4 and 11 for the South Cameron Salvage Sale (1997-98) and adjacent to Units 5 and 7-10 for the Guide Timber Sale (2001-02). Surveys on the remaining units were completed during June of 2003. No sensitive plants were found during any of these surveys, although suitable habitat was found for turkey-peas, woolly-head clover, hollyleaf clover, Lemhi penstemon, Rocky Mountain paintbrush, dwarf onion and taper-tip onion (see Table 3-21).

Existing Condition – Noxious Weeds

Spotted knapweed (*Centaurea biebersteinii {C. maculosa}*)
The Bitterroot National Forest is currently infested with about 264,000 acres of spotted knapweed (USDA Forest Service 1996). It is most common below 6500 feet on open, south or west-facing slopes, but can be found at higher elevations on extreme southern aspects. There is a strong correlation between canopy closure and knapweed coverage; with more sunlight there is an increased likelihood of infestation. Knapweed infestation is also correlated with aspect, soil type and the degree of soil disturbance. It is most commonly found on dry, sterile, gravelly, or sandy soils in pastures, and will quickly invade disturbed sites such as road and railroad right-of-ways, waste places, abandoned fields, timber harvest units and overgrazed rangeland. It is not common on cultivated land or on irrigated pasture. Spotted knapweed is not usually found in shaded areas. Ponderosa pine and/or Douglas-fir bunchgrass types, dry shrub communities and scree types are the most susceptible to knapweed invasion (Losensky 1987).

Current treatments for spotted knapweed include mechanical (hand pulling and mowing), biological and chemical. Hand pulling has proven to be less than 10% effective, is costly, and can only be practically accomplished for small areas. Mowing has been done at recreation sites to make outdoor activities more accessible and reduce seed production, although it does not reduce the number of plants. Several biological agents have been released throughout the Forest specific for spotted knapweed, as shown in Table 3-20.

Table 3- 20 Biological Agents Released for Spotted Knapweed

Agent	Mode of Action (general)
Agapeta zoegana (moth)	Root miner
Bangastemus fausti (weevil)	Seed head feeder
Chaetorellia acrolophi (fly)	Seed head feeder
Cyphocleonus achates (weevil)	Root miner
Larinus minutus (weevil)	Seed head feeder
Larinus obtusus (weevil)	Seed head feeder
Metzneria paucipunctella (moth)	Seed head feeder

Agent	Mode of Action (general)
Pelochrista medullana (moth)	Root miner
Sphenoptera jugoslavica (beetle)	Defoliator, root miner
Terellia virens (fly)	Seed head feeder
Urophora affinis (fly)	Seed head feeder
Urophora quadrifasciata (fly)	Seed head feeder

Biological control agents are more of a long-term solution and no decrease in knapweed populations is expected until these insect levels have increased. Biological control agents should decrease knapweed seed production by up to 80% once they become well established. In the meantime, chemical control methods (especially picloram) appear to be the most successful for treatment of smaller infestations of knapweed or to aid in containment of existing populations (USDA Forest Service 1996).

Spotted knapweed is common on roads and open, south or west-facing slopes in the Lyman project area.

Houndstongue *(Cynoglossum officinale)*

Houndstongue is typically found along roadsides, trails, and disturbed areas especially along logging roads and heavily grazed areas. A strong correlation between cattle grazing and location of houndstongue was found on the Bitterroot National Forest (Losensky 1987). Unlike spotted knapweed, it is tolerant of shade, but does best in full sun, if enough water and nutrients are available. Since grazing is not a large management activity on the Bitterroot Forest it has been found mostly in localized areas and does not presently occur in large acreages on the Bitterroot Forest. The Lyman drainage is one area where grazing has occurred, as well as previous logging activity. Houndstongue has been found scattered along roads and disturbed areas throughout the project area.

Canada thistle *(Cirsium arvense)*

Canada thistle reproduces both by seed and by lateral roots, however most of its reproductive energy is put into vegetative propagation (USDA Forest Service 2002). It can regenerate from root fragments less than an inch long. Male and female flowers are produced on separate plants so cross pollination is necessary for seed production. Due to its extensive lateral root system, Canada thistle is not easily eradicated once it becomes well established, but certain herbicides can be effective. Canada thistle is currently known to infest about 25 acres on the Forest, mostly along the Larry Creek Drainage. Sites susceptible for invasion include timber harvest/salvage areas, roadsides, and riparian areas. It was found in a few locations in the project area.

St. John's wort *(Hypericum perforatum)*

About 750 acres of Bitterroot NF lands are currently known to be infested with St. John's wort (USDA Forest Service 1996). Populations are scattered throughout the Forest and appear to have no particular affinity to a certain type habitat. Road shoulders provide the most likely location for St. John's wort; otherwise it has been associated with logging, grazing or fire disturbance. In grass communities it appears to out compete knapweed, but is not as competitive in forested areas (Losensky 1987).

A containment strategy including mechanical and chemical treatment methods has been recommended. A biological control agent appears to be fairly successful in other areas, but hasn't worked as well in the western Montana climate. Reintroductions may be attempted hoping for better success. Other biocontrol methods are being investigated (Losensky 1987). A patch of St. John's wort was found in Unit 13 of the Lyman project area.

Sulfur cinquefoil (*Potentilla recta*)

Over 2500 acres of land on the Bitterroot NF are known to be infested with sulfur cinquefoil (USDA Forest Service 1996). Sulfur cinquefoil is adapted to a wide range of environmental conditions. It has been found growing in open forest, grasslands, and disturbed areas, often associated with spotted knapweed. Sulfur cinquefoil can out-compete spotted knapweed for habitat.

A containment strategy has also been recommended for sulfur cinquefoil, utilizing chemical methods. No other method of control appears to be as effective for this weed species. A patch of sulfur cinquefoil occurs on road 73167 adjacent to Unit 4.

Tall buttercup *(Ranunculus acris)*
Tall buttercup is known to occur on about 25 acres on the Forest and appears to be increasing. Sites most susceptible to invasion include sub-irrigated and wet meadows and riparian zones. Tall buttercup was found in wet areas in Unit 9.

Table 3- 21 Sensitive Plants and Noxious Weeds

Unit #	Sensitive Plants Present	Sensitive Plant Habitat Present	Noxious Weeds Present
1	None found	Turkey-peas, hollyleaf clover, and woolly-head clover with some Rocky Mountain paintbrush, dwarf onion, and taper-tip onion habitat in more open areas.	Some Canada thistle; spotted knapweed along road
2	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Spotted knapweed along road, some houndstongue.
33	None found	Turkey-peas, hollyleaf clover, and woolly-head clover	Houndstongue; spotted knapweed along road and ridge on south end of unit.
4	None found	Turkey-peas, hollyleaf clover, and woolly-head clover with some Rocky Mountain paintbrush, dwarf onion, and taper-tip onion habitat in more open areas.	Spotted knapweed in open areas, some houndstongue and Canada thistle.
5	None found	Turkey-peas, hollyleaf clover, and woolly-head clover	Spotted knapweed and houndstongue in open areas.
6	None found	Turkey-peas, hollyleaf clover, and woolly-head clover	Spotted knapweed along road.
7	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Some houndstongue.
8	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	None found, spotted knapweed along roads.
9	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Some spotted knapweed, houndstongue, and tall buttercup.
10	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Some spotted knapweed and houndstongue.
11	None found	Turkey-peas, hollyleaf clover, and woolly-head clover with some Rocky Mountain paintbrush, dwarf onion, and taper-tip onion habitat in more open areas.	Some spotted knapweed and houndstongue
12	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Spotted knapweed high below Road 311 on south border of unit scattered along other roads.
13	None found	Turkey-peas, hollyleaf clover, and woolly-head clover with a small amount of Rocky Mountain paintbrush, dwarf onion, and taper-tip onion habitat in more open areas.	Spotted knapweed mostly along road and some St. John’s wort.
14	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Houndstongue on Road 13304.
15	None found	Turkey-peas, hollyleaf clover, and woolly-head clover.	Small amount of spotted knapweed and Canada thistle.

Environmental Consequences

Sensitive Plants and Noxious Weeds

<u>Effects Common to Action Alternatives</u>

Timber harvest activities followed by under burning on lower elevation south or west facing slopes have some potential for spreading noxious weeds. The degree of risk is related to the condition of the trees being harvested, the type of logging systems used and the post-harvest fuel treatment. Any harvest activity that reduces canopy cover to less than 40% can create openings conducive to noxious weed encroachment. The proposed activities would harvest dead or dying trees so the resulting loss in canopy cover would not be as great as the loss of live, full-canopied trees. There may be some isolated areas of dense trees where the branches and trunks on the trees create enough shading to deter weed encroachment, but generally the amount of canopy lost from removal of dead and dying trees would be significantly less than from live trees. In most areas, the fires and resulting decrease in shade created improved weed habitat. All ground-based logging would be accomplished over snow and/or frozen ground, greatly reducing the risk of ground disturbance, another cause of weed colonization. Skyline cable logging over bare ground may cause ground disturbance within the cable corridors, but the amount of disturbance would be minimal compared to non-winter ground-based skid trails. Fuel treatments on some of the units include burning piles or jackpot burning. Studies in Montana and Michigan show varying responses of knapweed to burning (USDA, FEIS 2003). In western Montana it appears that the more vegetation consumed in a fire on sites previously infested with knapweed, the higher the probability of spotted knapweed spreading into newly opened areas in its immediate vicinity. Observations two years after the 2000 fires on the Bitterroot Forest indicate that areas where spotted knapweed was previously established have notably healthier looking plants with new seedlings colonizing bare soil nearby (personal observations, 2002). Areas that weren't previously infested with knapweed are not currently seeing new invaders other than some bull thistle *(Cirsium vulgare)* (Sutherland, personal communication). Native vegetation appears to be recovering well enough to compete with any new invaders on sites not previously infested. In the Lyman project burn piles should be kept small enough to reduce the risk of burning the organic layer of soil in order to assist in natural vegetative recovery and reduce the risk of weed colonization.

Houndstongue is scattered throughout the Lyman analysis area. This noxious weed has barbed seeds that can remain viable for 2 to 3 years (USDA 2003). Seeds readily attach to clothing and animal fur enabling them to be carried miles away from their original location to areas that are houndstongue-free. Houndstongue can form dense colonies and displace native plant species. There is not enough information currently available on the effect of fire on houndstongue. In northeastern Oregon houndstongue did not establish on a severely burned site, but did become established on a moderately burned site (USDA, FEIS 2003).

Impacts of Alternative 1 (No Action)

The No Action alternative proposes no ground disturbing activities in areas where noxious weed populations occur, so in the short term, this alternative is unlikely to adversely impact sensitive plant habitat or native plant communities by spreading weeds. However, with continued fire suppression and changes in fuel loadings, a dry season fire event may result in a more intense fire, increasing the possibility of soil heating and damage to below ground plant tissue in native plants. This would compromise the ability of the native plant community to compete with noxious weeds and may also result in more bare soil and an increased chance of noxious weed spread As spotted knapweed increases, cover of more desirable, but less competitive native plant species can be significantly reduced, sometimes by as much as 60 to 90 % (Duncan 1997). Rare plant species can be particularly vulnerable since their numbers tend to be lower. With no native vegetation left for competition the knapweed infestation could be worse than with a planned ignition under moister conditions.

Impacts of Alternative 2

<u>Direct and Indirect Effects</u>

Alternative 2 proposes various prescriptions for salvage, salvage/regeneration and sanitation harvest to treat fuels on 569 acres in the Lyman Creek drainage. In addition one temporary road would be constructed to access Unit 5, 1.4 miles of road would be decommissioned and 12.6 miles of road would be put in storage with removal of culverts. No sensitive plants were found in the project area, although potentially suitable sensitive plant habitat does exist for

Lemhi penstemon, Rocky Mountain paintbrush, hollyleaf clover, woolly-head clover, turkey-peas, dwarf onion and taper-tip onion (see previous table).

Since no sensitive plant species were found impacts from proposed activities should not adversely affect individual plants, but there may be adverse impacts to potentially suitable sensitive plant habitat. Proposed activities may increase the likelihood of weed spread due to ground disturbance. Certain logging methods and prescribed burning carry the risk of spreading weeds as described above in "Effects Common to All Action Alternatives." The spread of weeds could increase competition for native plant habitat possibly adversely impacting potentially suitable sensitive plant habitat. Spotted knapweed increase is probably more controllable with low-severity spring burns than fall burning when conditions may be drier, or a naturally occurring fire with large fuel accumulations (see Effects of No Action Alternative above). A high severity burn would open the canopy more, increasing the chances of knapweed spread, since knapweed responds positively to increased sunlight (Losensky 1987). Burning (both piles and jackpot) under conditions where the soil and vegetation are still holding moisture would reduce the severity of the fire and the risk of creating large openings and bare soil. These conditions may not be ideal for achieving the desired effects of returning fire to the ecosystem, however, without these conditions or without any treatments at all, the risk of a more impactive wildfire is increased.

Units 2, 5, 7 and 10 are firewood only units and the effects of logging would be fewer compared to the harvest units. Impacts will be restricted to areas that can be reached from the road with a winch. There is still a possibility of spreading weeds, but monitoring and treatment should be easier due to easy access from the roads. All other units would have potentially ground disturbing impacts further in the units, making weed encroachment more risky in terms of monitoring and control.

Areas should be treated with herbicides prior to implementing timber harvest activities to help reduce the risk of spreading weed seed. Herbicide treatments in the Lyman Creek area were analyzed in the 2003 Noxious Weed Treatment Project EIS. After harvest, units should be monitored to determine if follow-up weed treatments are necessary. Any areas where new ground disturbance has occurred should be seeded as soon as feasible to aid in competing with noxious weeds. Any machinery working off road should be cleaned as required in FSM (Forest Service Manual) 2080 and timber sale contract clauses. If these mitigation measures are followed the risk of introducing or spreading noxious weeds should be reduced considerably.

Temporary Roads
One 1,300-foot temporary road is proposed to access Unit 5. Temporary road construction is more likely to spread weed seed than timber harvest due to the amount of ground disturbance and bare soil exposed, and the additional vehicular traffic. Trucks and logging equipment can spread weeds to harvest units if not properly cleaned. In order to reduce this risk all machinery used to build the road and for timber harvest activities would be cleaned as required in FSM (Forest Service Manual) 2080 and timber sale contract clauses. The temporary road would be obliterated and seeded as soon as possible after use. Topsoil should be saved for use in revegetating the road since it contains native seeds and plants that could become re-established or germinate on the site after obliteration. This affords the best chance of rehabilitating the site to pre-construction condition.

Watershed Improvement
In addition to the above activities, certain roads are proposed for maintenance, storage, or decommissioning. Road storage and decommissioning should help restore native plant communities on otherwise compacted, disturbed sites. It will still be important to follow guidelines established in FSM 2080 and contract clauses for road work in order to reduce the risk of spreading weeds. All equipment should be cleaned and all seed and mulch used should be certified weed-seed free. Closing roads to vehicular traffic would reduce the risk of spreading weeds by forest users. Shrub plantings would aid in preventing weed spread by increasing the rate of recovery of shade-producing plants. Spotted knapweed prefers full sunlight.

Cumulative Effects
Road construction, past timber harvest, fire, and grazing (East Fork Allotment) in the Lyman area has probably contributed to the spread of spotted knapweed and houndstongue. Fuel reduction activities in nearby areas associated with the Burned Area Recovery Project (i.e. Bitter Camp, Elk Point II, Little Bull) as well as on State lands all contained mitigation measures for weed prevention, such as winter logging, helicopter logging, and cleaning equipment. The reduction of fuels on these adjacent lands should help reduce the severity of future wildfires. A

severe fire event in the Lyman Creek drainage with no fuel reduction could contribute more to the spread of weeds than the proposed timber harvest activities. Post-fire mushroom harvesting has virtually ended in the Lyman area. Morels (the most sought after post-fire mushroom) are most common the first year after a fire and usually aren't numerous enough to warrant commercial harvest after that. The Lyman area and all the burned areas from the 2000 fires are being monitored for new weed invaders as a result of fire suppression activities, out-of-state mushroom harvesters, and other activities. The East Fork Grazing Allotment has been rested the past two years, which should help vegetation recover further from the 2000 fires and reduce the risk of weed spread by livestock. Winter ground-based harvest methods required for the action alternatives should also reduce the risk of noxious weed invasion, as well as removing trees that might add fuel for future fire events. Skyline cable logging in both action alternatives is more likely to spread weeds, but with sufficient slope angle logs should get nearly full suspension reducing the amount of ground disturbance. Regional Soil Quality Standards state that no more than 15% of an activity area can be detrimentally impacted, so no more skid trails than necessary to keep to the 15% standard would be used. The average soil disturbance from skyline cable harvest is 2% to 5% (USDA Forest Service 2001). The Lyman drainage was analyzed in the 2003 Noxious Weed Treatment Project EIS for herbicide application so the spotted knapweed, houndstongue and Canada thistle that occur within units or along roads can be treated. Treatments should occur prior to timber harvest and possibly afterwards if monitoring indicates weed infestations are growing or new infestations are occurring.

Impacts of Alternative 3

Direct and Indirect Effects

The impacts of timber harvest activities proposed in Alternative 3 would be similar to those in Alternative 2, although 195 acres fewer would be treated. All watershed improvement activities would be the same as in Alternative 2. With fewer acres being treated the risk of weed spread from harvest activities would be reduced, but there would be less fuel reduction occurring thereby potentially increasing the risk of a severe wildfire event in the future. As mentioned above for Alternatives 1 and 2, if a wildfire occurs without timber harvest, chances are the fire will be intense enough to create more bare soil than the proposed activities thereby increasing the risk of noxious weed colonization.

Cumulative Effects

Cumulative effects would be the same as described previously for Alternative 2, taking into consideration the direct and indirect effects mentioned above.

Consistency with the Forest Plan

Sensitive Plants

The Forest Plan specifies (Forest Plan, Chapter II, page 21) that vascular plants identified as rare, pending study, or proposed as threatened or endangered will be identified and protected. The plants termed 'rare' are the plants on the Regional Forester's sensitive species list, as well as any plants identified by the Forest as being of special concern. A stated goal of Forest Service policy is to maintain population viability over a species' geographic range. Information on the number of plants required for maintenance of viable populations is not available. Therefore a conservative approach is taken when determining the effects of management activities. All alternatives would be consistent with the Forest Plan direction for sensitive plants.

Noxious Weeds

The Forest Plan (page II-29) states that the primary means of preventing, containing or controlling noxious weeds will be through vegetative management practices and by use of biological control agents. Herbicides can be utilized to provide short-term protection on specific sites, after appropriate environmental analysis. All alternatives would be consistent with the Forest Plan direction for sensitive plants.

HERITAGE RESOURCE

Introduction

Heritage resources (also known as cultural resources) include buildings, structures, sites, areas, and objects of scientific, historic, or social value. They are irreplaceable, nonrenewable resources documenting the legacy of past human use of the Forest.

Regulatory Framework

The primary legislation governing modern heritage resource management is the National Historic Preservation Act (NHPA) of 1966 (amended in 1976, 1980, and 1992). All other heritage resource management laws and regulations support, clarify, or expand on the National Historic Preservation Act. Specific Forest Service heritage resource management practices are based on Federal Regulations 36 CFR 800 (Protection of Historic Properties), 36CFR 63 (Determination of Eligibility to the National Register of Historic Places), 36 CFR 296 (Protection of Archaeological Resources) and Forest Service Manual 2360 (FSM2360).

Other laws addressing various aspects of heritage resource management on the National Forests include the National Environmental Policy Act of 1969 (NEPA), the National Forest Management Act of 1976 (NFMA), the Antiquities Act of 1906, the Historic Sites Act of 1935, and the Archaeological Resource Protection Act of 1979, as amended in 1988 (ARPA). Along with ARPA two other regulatory acts, the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) and the American Indian Religious Freedom Act of 1978 (AIRFA), define the role of Tribes in federal heritage resource management. The National Historic Preservation Act (NHPA) also specifically calls for Tribal participation in the NHPA Section 106 consultation process.

The Bitterroot Forest Plan tiers to these laws and regulations, as do Forest-wide Management Standards calling for the preservation of significant Heritage resources in place wherever possible, cultural resource inventory for most ground-disturbing activities, and consultation with tribal religious leaders on sites of spiritual significance.

The Confederated Salish and Kootenai Tribes of the Flathead Reservation regard the entire Bitterroot National Forest as an area of concern. The tribes exercise treaty rights on the Forest under the 1855 Hellgate Treaty, and are consulted on all Forest undertakings. Consultation with the Confederated Salish and Kootenai Tribes regarding the Lyman Salvage sale took place on May 21, 2003. No specific cultural concerns were identified, but the Tribes requested that consultation be considered ongoing until all Heritage surveys in the Lyman project area were completed. These surveys were completed on June 3, 2003, with no cultural resources located within the Lyman project area. The Lyman sale is not within areas of cultural concern identified by the Nez Perce Tribe or the Shoshone-Bannock Tribes of Fort Hall.

Area of Analysis

For heritage resource purposes, the area of analysis for the Lyman Salvage Sale encompassed the entire Area of Potential Effect in which project activities could have direct, indirect or cumulative effects on cultural resources in or near the project area. This analysis area comprised all national forest lands within and immediately contiguous to the project boundaries, as well as any adjacent areas identified as having high probability for cultural site occurrence.

Effects Analysis Methods

For heritage resource purposes, the area of analysis for the Lyman Salvage sale comprises all national forest lands within and immediately contiguous to the project boundaries, as well as any adjacent high probability areas. Based on this information, heritage specialists determine whether existing cultural resource data is adequate to complete the environmental analysis and disclose potential effects on cultural resources. If the information is insufficient, additional research and/or inventory is undertaken. Where additional inventory is needed, heritage personnel design a survey strategy to locate all historic properties within the area of potential effect. This strategy is designed in accordance with the criteria defined in “Site Identification Strategy Prepared for the Bitterroot, Flathead, and Lolo National Forests” (SIS). If a survey discovers previously unknown cultural resources, those resources are recorded and their National Register eligibility status determined in consultation with the Montana State Historic Preservation Office (MTSHPO). Both background research and fieldwork are documented in a report submitted to the MTSHPO. The heritage program manager consults with MTSHPO to determine the nature of the project’s effects on significant properties. If needed, the heritage program manager and MTSHPO work together to determine appropriate project redesign, restrictions, designation of sensitive areas, or mitigation measures. The heritage program manager coordinates recommendations, actions, and monitoring with the project leader, MTSHPO and interested Tribal preservation officials.

A project is determined to affect a historic property when project activities alter the characteristics that qualify the property for inclusion in the National Register of Historic Places (NRHP). In determining the effect, alteration to features of the property's location, setting, or use may be relevant, depending on the property's significant characteristics. An "adverse effect" results when the project may diminish the integrity of an historic property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include (but are not limited to): physical destruction, damage, or alteration of all or part of the property; isolation of the property from its setting; alteration of the setting's character when that character contributes to the property's National Register eligibility; introduction of visual, audible, or atmospheric elements out of character with the property or its setting; and neglect of a property resulting in its deterioration or destruction (National Register Bulletin #15; How to Apply the National Register Criteria for Evaluation, US Dept. of Interior, National Park Service, rev. ed., 1995).

The Forest Service Heritage Resource Program is responsible for managing cultural resources to prevent loss or damage before they can be evaluated for scientific study, interpretive efforts, or other appropriate uses. This requires projects to be implemented in a manner that avoids adverse effects on historic properties. If a proposed project would result in impacts to historic properties, project design should ensure that treatment of the property will conform to sound preservation practice and comply with all applicable preservation standards. If the potential for adverse effects cannot be avoided, appropriate mitigation treatments are determined in accordance with 36 CFR 800.5. As an example, mitigation of timber harvest impacts may include establishment of buffer zones, directional falling, alteration of harvest unit boundaries, changes in road locations, location of skid trails away from historic properties, limiting the harvest methods in certain areas, seasonal limitations, and restrictions on slash disposal or tree planting activities. Where a project has the potential to impact a property of Tribal concern, the Forest Service will consult with Tribal representatives to develop appropriate mitigation measures.

Within the Lyman Salvage Sale boundary, all areas that are considered "moderate-to-high probability for cultural resource occurrence" were surveyed on June 3, 2003. The area surveyed included all lands previously surveyed in 1982, 1992, 1993 and 199, and 2001. No sites had been recorded within the project area during the earlier surveys, and no new sites were discovered within the project area during the 2003 inventory.

Existing Condition

Between 1982 and 2001, six cultural resource inventories have been conducted within the proposed sale boundaries: Lyman Creek Timber Sale (82-BR-3-1, Light & McLeod), Sula Small Sales (92-BR-3-3, Varnum), DF Salvage Timber Sale (93-BR-3-12, Varnum), South Cameron Salvage (97-BR-3-1, Varnum), Upper Jennings Commercial Thin (97-BR-3-3, Varnum), and Burned Area Recovery (01-BR-SO-1, Hamilton). These inventories complied with all applicable federal requirements and were performed by and under the supervision of cultural resource specialists who met or exceeded federal professional standards for their positions.

In June 2003, all remaining unsurveyed moderate-to-high probability terrain within the analysis area received cultural resource inventory by a qualified archaeologist. No cultural sites are known to exist within the project boundaries. The nearest known site lies a half-mile outside the Lyman sale boundary. The existing condition is the desired condition for heritage resources within the project boundary, that is, all moderate-to-high probability terrain has received recent survey (2003) and the results have been documented. The resulting negative inventory report will be included in the Forest's 2003 annual compliance report to the Montana State Historic Preservation Office, as required under the terms of the Programmatic Agreement among the Forest Service Northern Region (Montana), the Montana State Historic Preservation Office and the Advisory Council on Historic Preservation.

Environmental Consequences

Because no cultural resources have been revealed within the project area by literature search, tribal and state preservation office consultation, and field surveys, it is believed the proposed activities would have no effect on cultural resources.

Consistency with the Bitterroot National Forest Plan and Other Regulatory Direction

Federal laws that direct and guide the Forest Service in identifying, evaluating, and protecting heritage resources regulate heritage and Tribal interests. All of the alternatives in this analysis would comply with federal laws. The Bitterroot Forest Plan tiers to these laws, therefore all of the alternatives would meet Forest Plan standards.

VISUAL QUALITY

Regulatory Framework

The Bitterroot National Forest scenic resource is managed by direction provided in the Bitterroot NF Plan (1987). Visual quality is assessed and evaluated under Landscape Aesthetics, USDA Forest Handbook Nr. 462, April 1974.

The Bitterroot NF Plan includes forest-wide management goals for scenery to:
Maintain a high level of visual quality on landscape seen from population centers and major travel routes, and adjacent to fishing streams.

Forest-wide Standards for Visual Quality include:

- The time required for openings to visually recover before adjacent stands can be harvested will vary by visual quality and other management objectives as determined through application of the visual management system and the project interdisciplinary team process. As a general guide, recovery in retention and partial retention areas, from middle viewing distances, occurs when the site is stocked with about 300 trees per acre, with the dominant tree being 20 feet tall. This condition is reached in 26 to 34 years from the time of harvest. Habitat types not typically capable of supporting 300 trees per acre generally recover in about 30 years. For *maximum modification* VQO (Visual Quality Objectives) areas, visual recovery occurs when a new forest stand is established and certified stocked.
- Openings created by timber harvest should be designed to blend with natural openings to the extent practical.
- The size, shape and location of the area between openings will be consistent with water, wildlife and visual resource considerations. Documentation of rationale and trade-offs will be required if the proposed openings are larger than the intervening “leave” islands.

The Bitterroot NF Plan includes Forest-wide management area (MA) standards:

- **MA-1**
  - ⇒ The VQOs are generally maximum modification and modification.
  - ⇒ Lands generally within 300 feet of major fisheries riparian areas and adjacent to roads and trails routes will be managed to maintain Partial Retention VQO.
- **MA-2**
  - ⇒ The VQO is modification.

Analysis Method

Management activities such as timber harvesting can affect forest scenic quality by changing the predominate form, color, line or texture in a given viewing area. The degree of visibility of these events (i.e., visual impacts) depends on the interaction of certain elements to the viewer such as:

- Slope and aspect of the land
- Surrounding landscape
- Frequency and duration of view

These factors have been incorporated into the analysis of the effects of each alternative relative to meeting VQOs. VQOs are minimum guidelines for meeting Forest Plan visual goals.

As discussed above, the Bitterroot National Forest's visual resources are managed under the USDA's National Forest Landscape Management System. This system employs an inventory of the attributes of each forest acre to produce a VQO that will correspond appropriately to Management Areas (MA) prescriptions developed in the Forest Plan.

Activities proposed in each alternative are discussed in detail in Chapter 2.

Existing Condition

The Lyman area is steep conifer covered hillsides and canyons. The majority of the area is a mosaic of burned timber lands with fingers and islands of green trees

Within the analysis area, 253 acres burned in high fire severity (44%), 47 acres in mixed fire severity (8 %) and 277 acres in low fire severity (48%).

The burned area dominates the viewed and existing human-made alterations are visually reduced. Scorched tree crowns and blackened boles are visible from Forest Service Roads #311 and Rd #723, the two main roads in the analysis area.

The proposed action is with in MA-1 and MA-2. The visual quality objectives (VQOs) for this proposed sale is modification and maximum modification VQOs.

The Lyman area is steep conifer covered hillsides and canyons. The majority of the area is a mosaic of burned timber lands with fingers and islands of green trees

Environmental Consequences

<u>Effects Common to Alternatives 2 and 3</u>

YARDING SYSTEMS

Skyline Yarding

This system takes logs from stumps to a landing using an overhead system of cables to which logs are attached and dragged through cable corridors throughout the unit. The corridors may leave straight lines either in a fan-shaped pattern or parallel lines on the landscape. Visibility is dependent on factors such as the slope and aspect of the land, surrounding landscapes, and frequency and duration of view. This affect becomes less noticeable with time.

Ground Base Yarding

This method is used on gentle slopes (less then 35% slope for downhill skidding, and 25% for uphill) that are generally removed from the seen area (mid and back ground views). Required winter ground based skidding leaves very little visual impact, other than the presence of stumps and slash. Evidence of activities is most noticeable at landings.

Post Harvest Activities

Post harvest activities such as weeding and jackpot burning would be noticeable in the foreground during implementation and for a few years thereafter. The visual effects would be relatively minor.

Road Storage and Decommissioning

Road storage and decommissioning may have a short-term negative effect in the foreground. Within a year, disturbed sites would begin to re-vegetate, decreasing the visual effects of the disturbance in the foreground. All road treatments described in Chapter Two would meet modification and maximum modification VQOs.

Alternative 1 (No Action)

This alternative does not include harvest activities or fuel treatment. Visual quality would not be affected with this alternative.

Alternative 2 (Proposed Action)
Treatment is considered on 569 acres. All units are within maximum modification and modification VQOs.

Twelve units would have some skyline yarding and 10 units would have some ground base yarding. All ground based yarding will be done in the winter. About 274 acres would be treated by ground base yarding and 295 acres be treated by skyline yarding.

The harvest activity would remove varying levels of dead and dying trees, depending on extent of mortality in a given unit. The activities described in detail in Chapter Two for this alternative would meet maximum modification and modification VQOs. Generally, forest users can begin to recognize a change in canopy cover in a green forest at 50% removal. Because of the mosaic burn/unburned pattern of these units, that percentage could be higher. Snags retained for wildlife and coarse woody debris and live trees that remain uncut would soften the visual impact.

No measures are recommended to mitigate effects to visual quality in this alternative. This alternative would meet the VQOs of maximum modification and modification.

Alternative 3
Treatment is considered on 374 acres. All units are with-in maximum modification and modification VQOs.

Nine units would have ground base yarding and eight units would have skyline yarding. All ground base yarding would occur during the winter. About 134 acres would be treated by ground based yarding and 240 acres would be treated by skyline yarding.

The harvest activity would remove varying levels of dead and dying trees, depending on extent of mortality in a given unit. The activities described in detail in Chapter Two for this alternative would meet maximum modification and modification VQOs. Generally, forest users can begin to recognize a change in canopy cover in a green forest at 50% removal. Because of the mosaic burn/unburned pattern of these units, that percentage could potentially be higher. Snags retained for wildlife and coarse woody debris and live trees that remain uncut would soften the visual impact.

No measures are recommended to mitigate effects to visual quality in this alternative. This alternative would meet the VQOs of maximum modification and modification.

Cumulative Effects
Effects of past wildfire on scenery, whether by human or natural ignition, are usually perceived as natural. Some activities such as fire line construction are perceived as human-caused and may adversely affect scenic quality. All suppression activities that caused disturbance have been fully rehabilitated. Past fires add to the vegetation mosiac in the East Fork drainage.

Past and on-going management activities like reforestation, trail construction, noxious weed treatment, personal-use firewood cutting, are not expected to have cumulative effects when combined with any of the proposed alternatives due either to the nature of the activity or its location.

Consistency with Bitterroot Forest Plan
All of the alternatives described in this analysis would meet Forest Plan standards, desired future conditions and visual quality goals.

RECREATION

Introduction
Recreational uses of the Lyman analysis area consist mostly of dispersed uses such as hunting, firewood gathering and viewing scenery by the local community, with minor uses of horseback riding, ATV and snowmobile riding. This area is open to day use outfitted hunting, but receives little use. There are no developed trails, developed recreation areas, roadless areas (inventoried or “unroaded”), wilderness areas, or proposed wilderness areas within the analysis area.

Regulatory Framework

National Environmental Policy Act (NEPA)

NEPA requires integrated use of the natural and social sciences in all planning and decision-making that affects the human environment. The human environment includes the natural and physical environment and the relationship of people to the environment (40 CFR 1508.14).

Bitterroot National Forest Plan Direction

Each Management Area (MA) denoted by the Forest Plan includes recreational goals and standards. The analysis area is located in Bitterroot Forest Plan Management Areas (MA) 1 and 2. Forest Plan management standards include: manage to provide recreation opportunities associated with roads and motorized equipment. Access will provide for roaded dispersed recreation activities.

Recreation Opportunity Spectrum (ROS)

Recreation Opportunity Spectrum is a land classification system of six management class categories, each being defined by its setting and by the probable recreation experiences and activities it affords. The six management classes are: urban, rural, roaded natural, semi-primitive motorized, semi-primitive non-motorized, and primitive. The recreation opportunity spectrum setting for the analysis area is roaded natural (forest practices may be evident and motorized vehicles are permitted on all or parts of the road system).

Travel Management

The Forest Travel Management Map displays current motorized travel restrictions, established under Federal Laws and regulations, on National Forest Land. In January of 2001, the Forest Service and Bureau of Land Management issued a decision to limit or restrict motorized cross-country travel. The decision restricts, yearlong, wheeled motorized cross-country travel. OHVs that are wider than the existing trail tread are prohibited.

Area of Analysis

The area used to analyze the recreation resource is the project area. This area was selected because proposed harvest, watershed restoration and reforestation might affect use and access for dispersed recreation uses.

Effects Analysis Methods

Roads analysis (FSM 7712.1) was conducted for the project area (project file).

Existing Condition

Recreational uses of the Lyman analysis area consist mostly of dispersed uses such as hunting and viewing scenery by the local community, with minor uses of horseback riding, ATV and snowmobile riding. This area is open to day use outfitted hunting, but receives little use.

Although a thorough inventory has not been completed, OHV user created trails probably occur occasionally in the Cameron, Lyman and Guide Creek drainages and use is low.

Roads 723 and 73026 are open yearlong to all motorized vehicles. All other National Forest roads within the project areas have seasonal or yearlong motorized travel management restrictions. The seasonal travel management restrictions prohibit motorized use of the roads during the general big game rifle-hunting season. Refer to the forest's Travel Management Map and Table 3-23 for specific seasonal and yearlong motorized use restrictions.

Environmental Consequences

Direct and Indirect Effects

Alternative 1 (No Action)

No activities are proposed in Alternative 1. This alternative would provide the most seasonal motorized access.

Neither travel regulations nor recreational use would change from the existing condition.

Effects Common to Action Alternatives 2 and 3

Proposed timber harvest activities would result in short term conflicts with general public dispersed recreational opportunities in the project area. The most effects would occur while the timber harvest activities would be occurring.

Noise and exhaust from equipment working on the project would impact recreational users within the area while the work is occurring. Smoke from prescribed burning would impact recreational users in the vicinity of and down wind from burning. Tree stumps and activity created slash would be apparent to Forest users traveling through treatment areas.

Most slash would be eliminated with prescribed burning. The forest floor and bases of trees would be charred during prescribed burning. Prescribed burning would kill smaller trees and some larger trees. Ground cover would re-sprout rapidly the spring following burning due to the nutrient flush from cool burns. Charred tree bases would take a few years for the black to fade out.

Recreational users traveling on Road 311 would meet logging trucks for the relatively short period of time log hauling would occur. Dust from equipment working on the project during spring, summer or fall months could impact recreational users within the area while the work would be occurring. Short traffic delays could occur on roads open to motorized use, when timber harvest operations are occurring adjacent to them.

Road decommissioning and storage activities in Alternatives 2 and 3 result in year long motorized access restriction on roads that are currently seasonally restricted. The entire length or ending segments of six roads (#'s 73145, 73167, 73169, 73170, 73168, 74940) that are currently seasonally restricted to motor vehicle use would be restricted yearlong (Table 3-23). These six roads and road segments total 5.6 miles.

Roads 73168, 73145, 73172 and 13304, proposed for storage, have parallel roads above or below them. Other roads are being closed as culverts in the end road segment would be removed and the remaining sections of road beyond the culvert placed in storage.

The beginning 1.6 mile segment of Road 13304 would change from a yearlong motorized access restriction to open yearlong. This is proposed in order to partially off-set the reduction in motorized access from road storage or decommissioning in the project area. This road is considered a good candidate because it has low risks to resources. Road 13304 runs on the contour 1.6 miles to where the road storage work would begin. There is a good vehicle turnaround site at that point. This 1.6 mile road segment is in a relatively benign location from a watershed standpoint; it has a stable surface, a flat grade, and crosses no perennial streams. Opening this road segment would provide dispersed recreational access opportunities. Use is expected to be low.

Table 3- 22 Alternatives 2 and 3 - Watershed Improvement Road Work and Resulting Motorized Access

Road Number	Total Length	Current Travel Status	Road Maintenance (Miles)	Road Storage (Miles)	Road Decomissioning (Miles)	Post Project Travel Status
311	>20	Seasonal	22.4			Seasonal
717	3.0	Open	2.2			Open
1398	2.6	Open/Seasonal	2.6			Open/Seasonal
1398A	2.0	Seasonal	0.6			Seasonal
73026	2.7	Open	1.5			Open

Road Number	Total Length	Current Travel Status	Road Maintenance (Miles)	Road Storage (Miles)	Road Decomissioning (Miles)	Post Project Travel Status
73145	2.6	Seasonal		2.6		Year-long
73167	2.7	Seasonal	2.4	0.3		Seasonal/Yearlong
73169	1.3	Seasonal	1.0	0.3		Seasonal/Yearlong
73170	1.0	Seasonal	0.8	0.2		Seasonal/Yearlong
73168	1.8	Seasonal		1.8		Year-long
74940	0.4	Seasonal			0.4	Year-long
73172	3.3	Year-long		3.3		Year-long
13304	5.1	Year-long	1.6	3.5		Open / Year-long
73219	1.0	Year-long			1.0	Year-long
73220	0.6	Year-long		0.6		Year-long
Total			**35.1**	**12.6**	**1.4**	

Cumulative Effects

Timber harvest and post-harvest fuel and cultural activities in Alternatives 2 and 3 would have few and relatively minor cumulative impacts to recreational uses on the Sula District and Bitterroot National Forest. Recreation use on this part of the forest is low, and what use does occur may be temporarily displaced to the ample other areas of the forest where a roaded natural setting is available.

Watershed improvement roadwork would result in a 5.6 mile reduction in seasonal motorized access opportunities. These restrictions would occur on relatively short spur roads in an area where numerous other seasonal motorized access opportunities exist. The restrictions would result in a relatively minor cumulative reduction in motorized access opportunity on the forest. This would be partially offset by removing the yearlong restriction on a 1.6 mile segment of one spur road.

Table 3- 23 Motorized Access After Project Completion

Criteria Motorized Access	Alt 1	Alt 2	Alt 3
Road miles open year round	10.5	12.1	12.1
Road miles open seasonally	56.5	50.9	50.9

* Based on road analysis of 3 third-order drainages where harvest units are located.

Regulatory Framework and Consistency

All alternatives maintain adequate recreational opportunities and meet Forest Plan standards for Management Areas 1 and 2.

ECONOMICS

Introduction

This economic efficiency analysis compares the differences of resource inputs and outputs among the alternatives that can be quantified in terms of dollars. Timber and fuels treatment activities are the only resources with dollar quantifiable inputs and outputs that have been identified for this proposal. Other resource inputs and outputs that can't easily be quantified in terms of dollars (because their values are largely non-marketable and subject to individual interpretation) are discussed elsewhere in this document.

Regulatory Framework

The Bitterroot NF Plan includes Forest-wide management goals to:

- Provide sawtimber and other wood products (including firewood for personal or commercial use and houselogs) to help sustain a viable local economy.
- Provide firewood for personal and commercial uses.

- Strive for economically efficient management.

The Bitterroot NF Plan also includes Forest-wide management objectives (USDA Forest Service, 1987a) to:

- Offer affordable sales.

Forest Service policy sets a minimum level of financial analysis for project planning (FSH 1909.17). Forest Service managers are not required by law or policy to make a profit on timber sale projects. However it is policy to operate timber sales in the most cost efficient manner practicable to achieve the objectives outlined by Forest Plans and to provide timber where long-term benefits exceed costs (USDA, Forest Service, sec. 3422.22c).

Analysis Methods

An economic efficiency analysis is done to help in making decisions about whether to proceed with project investments and which alternative should be implemented to achieve Forest Plan objectives. The analysis deals with project-level financial attributes (predicted costs and revenues) of each alternative. Alternative 1 has no activities associated with it. Alternatives 2 and 3 have activities that vary in degree. These variables include the type of logging system recommended, method of fuels treatment and value of the timber removed. Table 3-24 below shows a summary of the proposed activities for each action alternative.

Environmental Consequences

Table 3-24 is derived from outputs from an economics spreadsheet. Inputs such as cost of each type of logging system by acre and value of the board feet of each species were used to generate reports. These detailed reports as well as a breakdown of activities and costs for each unit can be found in the project file.

Table 3- 24 Economics Summary for Timber Harvest and Slash/Fuels Activities

	No Action	Alternative 2	Alternative 3
MBF to Remove	0	2678	2062
Cost of logging	0	($531,780)	($418,940)
Timber receipts	0	$645,928	$526,023
Cost of Slash/Fuels Treatment	0	($30.980)	($29,060)
Net Value	0	$83,168	$78,023

*Net values do not reflect costs incurred for culvert replacements or road obliteration

Proposed reforestation would cost an estimated $180,000 for Alternative 2 and $160,000 for Alternative 3.

Proposed watershed improvement roadwork would cost an estimated $173,425 for Alternatives 2 and 3. The road maintenance work would be accomplished either partially or entirely with the project harvest contract, and in effect would be financed by the value of forest products harvested. The road storage and decommissioning work would likely be funded with appropriated watershed funds.

FIRE AND FUELS/AIR QUALITY

Introduction

This section discusses the impacts of the alternatives on the fire and forest fuels related issues. Although “fire” is an environmental process and not a “resource” per se, and “forest fuel” is the amount and arrangement of vegetation and likewise not a “resource”, the environmental consequences of the alternatives on these two related topics are important both ecologically and to human uses and values. The impacts of fuels treatments on air resources will also be discussed.

Regulatory Framework

Refer to Chapter 3 – Vegetation for a comprehensive discussion of the applicable regulations, standards and policies that guide vegetation management, including fuels. Specific regulations and policies relevant to fire and fuels include:

- Forest Plan direction for MA-1 and 2 includes: “Apply fuels treatments and site preparation that are coordinated to minimize fire danger, insect and disease problems, and secure establishment and protection of new stands”. Additional Forest Plan standards for MA-2 includes, “reducing activity fuels to 1-1/2 feet to provide for big game winter habitat”.
- Bitterroot NF Fire planning direction is to provide fire control measures that protect timber investments and value.
- Current National direction emphasizes firefighter and public safety in wildland-urban interface areas through vegetation manipulation using both mechanical and prescribed fire treatments.
- National and State Air Quality Standards for PM10 and PM2.5 apply to this project.

Area of Analysis

The analysis area for direct and indirect effects is the project area in each of the alternatives. This area is south of Cameron Creek, north of Guide Saddle, east of State lands, and west of the unnamed divide that runs northeast from Guide Saddle. Cumulative effects analysis area includes lands surrounding the project area, including French Basin, Jennings Camp Creek, and south to the East Fork Bitterroot River.

Effects Analysis Methods

Fuels and fire indicators for analysis will consist of:

- Acres treated by fuel reduction activities
- Smoke emissions
- Treatment costs

Total fuels loading, including standing dead and down dead forest vegetation, are assessed before and after treatments using ocular estimates and photo guides (Fischer, 1981).

Estimates of emission created through prescribed fire treatments will be conducted per *Guidelines for Estimating Volume, Biomass, and Smoke Production for Piled Slash (Hardy, 1996.)*

Existing Condition

A discussion of the existing condition for fire and fuels is included in the Vegetation section of Chapter 3 of this EA. Fuel loading levels are similar to those described in the Bitterroot Burned Area Recovery FEIS (2001). Standing dead and surface fuel loads vary within the activity units. Approximately 37-66 tons/acre exist in the moderate severity Douglas-fir beetle salvage units and 25-63 tons/acre in high severity 2000 fire salvage units. Fuel loads could double as a result of Douglas-fir beetle mortality in activity units that burned at mixed (low to moderate) severity in 2000.

Historic fuel loads vary between vegetation response units (refer to the Forest Vegetation report). The fires of 2000 significantly reduced fuels and abated the fire risk in the analysis area for the next decade or more. As a result of the fires of 2000, fire and insect killed trees occur across the entire analysis area with a subsequent increase in standing dead trees, which represent potential future surface fuels. The majority of the standing dead tree biomass will accumulate on the ground in the next two or three decades (Brown, et al, 2003). Future fires that occur in these areas of heavy fuel loads are expected to be more difficult to control due to the greater levels of large fuels on the ground (Brown et al, 2003). Most or all fine fuels and smaller size class woody surface fuels (0-6 inches) were consumed by moderate or high intensity 2000 fire (BAR FEIS, 2001) but three growing seasons has allowed some finer fuels (grasses and forbs) to accumulate. Future vegetative recovery will continue to add fine fuels. Recurrent downfall from burned trees will also add to the down woody fuel loads across the analysis area. Fuel load levels will continue to accumulate as trees fall and grasses, forbs, shrubs, and trees revegetate the analysis area. In general, post-fire and post-insect outbreak future surface fuel loadings will be above typical historic ranges (particularly in VRU2). Additionally, future potential fuel levels are greater than specified in the Forest Plan (minimize fire danger and secure protection of new stands in suitable timber MAs), and above fuel loads recommended by Brown, et al, 2003.

Environmental Consequences

Direct and Indirect Effects

Alternative 1

The No Action Alternative would result in the continuation of the current post-wildfires 2000 forest fuels condition, subject to natural rates of accumulation, deterioration, and wildfire. Sixty-two percent (243 acres) of the project lies within the Bitterroot Community-based Wildland Fire Risk Mitigation Plan's designated wildland-urban interface (WUI) zone and within Fire Management Unit I of the Bitterroot National Forest Fire Management Plan. All Wildland fires are suppressed per these plans. The Forest's success rate for containing wildfires to 100 acres or less, under pre-wildfires 2000 conditions is 97%. The post-wildfires 2000 fuel condition reduces firefighters' ability to use direct fire suppression tactics due to snag safety issues, future anticipated fuel accumulations would impact fire fighters ability to use direct tactics as well. This is likely to result in larger fire perimeters and higher fire intensity and severity in the future. This trend can be expected to continue in succeeding decades as vegetation regrowth proceeds and surface fuels increase.

Alternative 1 would produce no smoke from prescribed burns. Smoke from wildland fires would occur with all alternatives, dependent upon ignitions and weather. Wildland fires will continue to produce smoke, primarily during the summer months. The Montana and Idaho Departments of Environmental Quality air programs through cooperation with the Montana Idaho Airshed Group monitor emissions from wildfires, but standards only apply to prescribed fires. Therefore, Forest Plan standards for meeting EPA and State air quality standards for PM10 and PM2.5 would be met with this alternative.

Cumulative Effects

With no action, the fuel conditions and trends in the analysis area would continue, as described for the existing condition, and compared to the action alternatives would present a higher risk of larger and more severe fires in this area of the Sula District.

Direct and Indirect Impacts on Fire and Forest Fuels

Alternative 2

Alterative 2 would treat 569 acres and remove about 16,000 tons of dead and dying trees using conventional logging methods. Product deterioration (drying, checking, sapwood stain, etc) in the three years since the fires has resulted in fire killed smaller diameter trees having little to no marketable value as saw logs. The deterioration and product value varies by species. Recent fire salvage contracts on the Bitterroot NF have specified minimum utilizable DBH of Douglas-fir at 12.6", lodgepole pine at 9.6", and ponderosa pine at 14.6". The minimum utilizable DBH of recently dead or dying bark beetle-infested trees is 7.0". This means that any tree below these minimum DBH levels would not be removed for products. It is possible, however, that some of the trees that are smaller than these levels may be removed for firewood. The effect of leaving the unmerchantable trees is that heavier fuel loading than desired is left on sites where there is a notable component of these smaller trees. Reducing the fuel loadings to lower levels where there is no market for the biomass is very expensive and doing so is expected to be infeasible due to budget limitations. On sites where smaller trees are less prevalent, salvage logging would meet desired fuel load conditions.

Both activity fuels and natural fuels are proposed for fuel reduction treatment. Activity fuels are those created by the logging and temporary-road building. Activity fuels are proposed to be treated in portions of Units 1,4, 6,8 9,11,12,13,14 (419 acres, 74% of the analysis area), additionally natural fuels will be treated in portions of Units 9, 13, and 14 (144 acres, 25 % of the analysis area).

The fuel reduction goal in units proposed for activity and natural fuel treatments is to ameliorate the short and long-term fire risk by reducing the fuel load in areas where the post logging fuel loads exceed 30 tons per acre. Thirty tons` per acre is a threshold of fuel loading concern established by Brown, et al, 2003. There may some added increment of firefighting safety and effectiveness (and resource protection) that would be accompanied by removing 16,000 tons of heavy fuels from 569 acres, particularly in areas having lower stocking levels of smaller trees. Fire modeling done by Brown, et al, 2003 showed that fire behavior (flame lengths, fireline intensity, etc) was reduced following salvage harvest (to leave less than 30 tons/acre) compared to the same fire killed stand that was not salvaged and was allowed to fall naturally over time. The reduction of large fuels via salvage harvest and treatment of smaller diameter natural and activity fuels in the project area would not preclude future wildland fire but would increase the likelihood of safe and effective suppression effort in the 74%% of the analysis area that would be treated with Alternative 2.

The existing post-wildfires 2000 fuel condition would not be substantially improved by implementing this alternative, and in some cases would increase surface fuel loads in the short term. However, the limbs and tops left on site following harvest would eventually end up on the ground and present a fuel risk, even if no action were taken. In the longer term the fuels situation would be improved by removing large standing dead material that would otherwise fall and contribute substantially to the surface fuel profile. On sites where fuel loads are reduced to less than 30 tons per acre (standing dead or down), there would be an increased likelihood of safe and effective fire suppression. Targeted fuels would be eliminated using the most cost effective method. Units 2, 3, 5, 7, and 10 would have no fuels treatment other than that resulting from removing large fuels via harvest. Units 1 and 13 would have tops yarded to landings, and limbs lopped to less than 14 inches deep and left in the unit. Units 13 and 14 would be jackpot burned after yarding and slashing. Lopping without jackpot burning would occur in Unit 4. Units 6, 8, 9, 11, and 12 would be whole-tree yarded to a 3”dib top. Unit 9 would also have heavy concentrations of post-sale treatment slash hand piled and burned (approximately 10 acres.) Debris left at the log landings would be chipped and removed, or burned depending on alternative markets at the time of logging. The estimated cost of these treatments is $30,980 (Table 3-25). These activity fuel treatments would further reduce fire hazard in the activity units and provide an increased level of protection of reforestation investments.

Table 3- 25 Cost Comparison of Fuels Treatments by Alternative

Alternative	Burn Cost-Landing Piles ($)	Burn Cost-Jackpot or Handpile ($)	Yard Cost–Whole Tree or Tops ($)	Lop and Scatter Cost ($)	Total Costs ($)
	$80/AC	$60/AC	$50/AC	$50/AC	-------
1	0	0	0	0	0
2	400	4,680	15,750	10,150	30,980
3	500	4,260	14,950	9,350	29,060

All prescribed burning would be implemented in full compliance with Montana and Idaho DEQ air programs through cooperation with the Montana Idaho Airshed Group. Smoke from prescribed burning would cause short-term impacts on recreation and transportation in and near the project areas. The size and location of a prescribed burn and weather conditions (e.g., temperature, wind, atmospheric stability and mixing, and fuel moisture) determine how much and in what direction smoke travels. Residents in or near the mouths of drainages might experience short-term periods of smoke during early morning inversions.

National and State Air Quality Standards for PM10 and PM2.5 would be met with all action alternatives. Prescribed burning is proposed in Alternatives 2 and 3. Excess slash produced by treatment activities would be piled and burned, and some areas would be jackpot burned (accumulations burned in place). Smoke emissions vary with combustion efficiency and quantity of fuel burned. Machine piles and hand piles tend to produce more smoke than jackpot burns because much of the consumption occurs during the inefficient smoldering phase of combustion. The alternatives differ in the number of acres treated by each treatment method and thus in the quantity of smoke that would be produced by prescribed burning (Table 3-26).

Table 3- 26 Particulate Matter (PM 10) Generated by Alternative

Alternative	Rx Fire Natural Fuels (Acres)	Rx Fire Activity Fuel (Acres)	Rx Fire Total (Acres)	Total PM 10 Emissions Estimate (Tons)	Total PM 10 Emissions Annual Est.* (Tons)
1	0	0	0	0	0
2	10	83	93	14	5
3	10	77	87	13	4

* Calculated for a 3 year implementation

For the action alternatives that use prescribed burning, estimated PM10 emissions are much less than those estimated during the 2000 Bitterroot wildfires (66,000 tons). Downwind visibility may be temporarily affected.

Roads considered for storage or decommissioning in Alternative 2 have been evaluated and subsequent changes in access are considered acceptable from a fire and fuels management standpoint.

Cumulative Effects
Alternative 2, in combination with the fuel reduction work accomplished by the Montana DNRC on the Sula State Forest in the Cameron Creek drainage, the Bitterroot NF Burned Area Recovery project salvage sales in the Cameron, Guide, and Jennings Camp Creek drainages, and other fuel reduction efforts such as the Middle East Fork Community Defense Zone project, would collectively contribute toward a slight reduction in long term (30-60 years) fuel and fire hazard at the landscape scale.

Direct and Indirect Impacts on Fire and Forest Fuels

Alternative 3

Alternative 3 proposes to treat 378 acres by removing 2,038 MBF, or about 12,200 tons of dead and dying trees by conventional logging methods. The same quandary regarding product value deterioration and meeting fuel reduction objectives described for Alternative 2 also applies to Alternative 3.

Both activity fuels and natural fuels are proposed for fuel reduction treatment. Activity fuels are those created by the logging operations. Activity fuels are proposed to be treated in portions of Units 1, 4, 6, 9, 11, 12, 13, 14, 15 (352 acres) and natural fuels would be treated in portions of Units 9, 13 and 14 (139 acres).

The fuel reduction goal is to ameliorate the short-term fire risk by reducing flammability through the elimination of the 3-8" diameter activity fuels where total post-logging fuel loads exceed 30 tons/acre. Targeted fuels would be eliminated using the most cost effective method. In this alternative, Units 5, 7, 8, and 10 are eliminated from the project. Additionally, Units 2 and 3 would have no fuels treatment except for landing debris. All other fuels treatments are the same as described in Alternative 2, except that Unit 15 (8 acres) is added for salvaging without fuels treatment (except landing debris). Debris left at the log landings would be removed, chipped and removed, or burned depending on alternative markets at the time of logging. The estimated cost of these treatments is $29,060, about $2,000 less than Alternative 2 (Table 3-25.) Direct and indirect effects of the salvage logging and activity fuel treatments would be similar to those described for Alternative 2.

Roads considered for storage or decommissioning in Alternative 3 have been evaluated and subsequent changes in access are considered acceptable from a fire and fuels management standpoint.

The smoke impacts and prescribed fire emissions would be very similar to those in Alternative 2 (Table 3-26).

Cumulative Effects
Cumulative effects to fire and fuel conditions are similar to those described for Alternative 2.

Consistency with the Bitterroot National Forest Plan and Other Direction

Alternatives 2 and 3 are consistent with Forest Plan standards, and they also meet the requirements of all other regulations concerning fire, fuels and air quality. Alternative 1 may not meet the Forest Plan standard to minimize fire danger and protect new stands in MAs 1 and 2. Due to the extent of the 2000 fires on the Bitterroot's suitable timberlands, full compliance with this standard is not considered feasible. Regardless, Alternatives 2 and 3 would be more consistent with this direction than taking no action.

WILDLIFE

Introduction

The analysis focuses on the current analysis area condition and effects to wildlife that would result from the alternatives. It includes an evaluation of present wildlife habitat and past natural (wildfire) and human activities (timber harvest, livestock grazing, road building, etc.) that have affected the existing condition. Potential natural vegetation is Douglas-fir forest, western ponderosa forest, spruce-fir forest, and foothills prairie. Timberline occurs at about 8,800 feet. Species presence and use are typical of the vegetation type and include big game (elk) wintering habitats, forest associated songbirds, and small mammals.

Regulatory Framework

The two principle laws relevant to wildlife management are the National Forest Management Act of 1976 (NFMA) and the Endangered Species Act of 1973 (ESA). Regulations promulgated subsequent to passing NFMA require the Forest Service to manage fish and wildlife habitat to maintain viable populations of all native and desirable non-native wildlife species and conservation of listed Threatened or Endangered species populations (36CFR219.19). Additional guidance is found in Forest Service Manual Direction which states; identify and prescribe measures to prevent adverse modifications or destruction of critical habitat and other habitats essential for the conservation of endangered, threatened, and proposed species (FSM2670.31 (6)). ESA requires Forests to manage for the recovery of threatened and endangered species and the ecosystems upon which they depend. Forests are required to consult with the Fish and Wildlife Service if a proposed activity may affect the population or habitat of a listed species.

The Forest Service Manual also directs the Regional Forester to identify sensitive species for each National Forest where species viability may be a concern. Forests are then required to monitor sensitive species populations and prevent declines that might require listing under ESA (FSM 2670.32 (4)).

The principle policy document relevant to wildlife management is the Bitterroot Forest Plan of 1987. This document provides standards and guidelines for management of wildlife species and habitats on the Forest. The Record of Decision (1987) for this plan requires retention of 25 percent of the big game winter range in thermal cover. Other Forest Plan standards related to maintenance of wildlife populations include standards for amount and distribution of old growth habitat by management area, retention of snags, maintenance of elk populations and habitat, and management of elk habitat effectiveness through the Travel Planning process (USDA, Forest Service, 1987).

Area of Analysis

The analysis area for all species (except lynx) is the three third-order drainages where harvest or watershed improvement road work is proposed (Project file, MAP-1). The area was chosen because it is large enough to assess the effects of the most far-ranging wildlife species likely to inhabit the area (elk). Elk commonly move in and out of the area, but most of the movements of elk are between summer and winter ranges within the analysis area. The fires of 2000 dramatically affected wildlife species habitat such that some habitats are temporarily unsuitable for certain species. Map III-1 shows 2000 fire extent and burn severity in the project vicinity. Several species however, for example, black-backed woodpeckers and elk have adequate habitat within the analysis area. An evaluation of effects of the proposed action on elk will look at habitat effectiveness as it relates to existing access since most coniferous vegetation has been removed by fire. Lynx habitat is evaluated within a lynx analysis unit (LAU).

Effects Analysis Methods

Some elements of wildlife habitat require a detailed analysis and discussion to determine potential effects on particular species. Other elements may either not be impacted or are impacted at a level which does not influence the species or their occurrence. Some species can be adequately addressed through project design. In these cases a detailed analysis is not considered necessary.

The Forest Plan and monitoring reports, Montana Heritage, Forest, and district wildlife databases, and survey records were reviewed to refine a regional list of species with potential to occur in the analysis area. A species was selected for analysis if the species on this list was present within the affected area or if habitats for that species had a high likelihood of being affected by the proposed actions. If it was determined that a specific habitat component important to several species might be affected by the proposed actions this component was included as a subject for detailed analysis. Snag habitat was analyzed in this way.

Current field information, aerial photos and databases provided the majority of information for detailed assessments of effects.

Elk habitat effectiveness, a method for analyzing elk security specified in the Bitterroot Forest Plan, was evaluated using the methodology from Lyon (1983). Elk security was analyzed following the technique developed by Hillis *et al.* (1991). Lynx habitat has been mapped using Satellite Imagery Land Classification with lynx analysis units delineated based on criteria from Ruediger et al. (2000). .

In summary, the effects on species likely to be affected by the proposed action will be assessed by evaluating the degree to which each alternative affects species likely to inhabit a severely burned landscape. Several big game species and several bird species that rely on burned trees inhabit the analysis area and could potentially be affected by proposed activities. Evaluating road density and big game habitat will assess effects on elk habitat and species viability. For black-backed woodpeckers and other burned area foraging bird species effects will be evaluated based on snag habitat.

Existing Condition

Table 3-27 provides an overview of the status of habitats and populations of threatened, endangered, sensitive, and management indicator species of the Bitterroot National Forest and in the Lyman analysis area.

Table 3- 27 Threatened, Endangered, Sensitive and Management Indicator Species of the Bitterroot NF

Species	ST[1]	Historical Presence[2]		Current Presence[2]		Habitat Comments/Issues Related to Project Area
		BNF	Lyman	BNF	Lyman	
Bald Eagle	T	Y	N	Y	N	No known historical nests; fall/winter presence on the Bitterroot River system around open water.
Grizzly Bear	T	Y	Unk	Y	N	No known grizzly bear in analysis area. Not habitat
Gray Wolf	T	Y	P	Y	N	Wolves have and continue to use the Bitterroot NF but wolves are not known to utilize the project area at this time.
Canada Lynx	T	Y	N	Y	N	Historically present, no recent sightings or records on the Bitterroot. Severe wildfire has removed live vegetation rendering habitat unsuitable.
Peregrine Falcon	S	Y	N	Y	N	No known nesting sites, current or historical, have been documented. Habitat is not present.
Flammulated Owl	S	Y	P	Y	Unk	The project area contains limited habitat potential for this species. Surveys indicate there are no known owls in the project area.
Harlequin Duck	S	Unk	N	Unk	N	Perennial mountain streams with < 3% gradient and shrub cover. No habitat present.
Townsend’s Big-eared Bat	S	P	P	P	N	No known caves that can function as hibernacula or maternity roosts are known in the project area.
Northern Bog Lemming	S	P	Unl	Y	Unl	Open glacial bogs dominated by thick mats of sphagnum moss and, to a lesser extent, mosses of other species. No known habitat in analysis area.
Black-backed Woodpecker.	S	Y	P	Y	Y	Expected beetle outbreaks will provide a good forage base to support a woodpecker population increase in the analysis area.
Wolverine	S	Y	Unk	Y	Unl	Wolverines are rarely located in burned-over areas. No known habitat favored by wolverine is present in the analysis area.
Fisher	S	Y	Unk	Unk	N	Preferred mature and old growth forests adjacent to streams are not present. No habitat present.
Northern Goshawk	S	Y	P	Y	N	Mature and old growth forests, especially in riparian areas are preferred. Fires of 2000 have eliminated all characteristics favored by this forest inhabiting species.
Northern Leopard Frog	S	Y	N	N	N	This species has probably been extirpated in the Bitterroot Valley. No habitat is present on public lands.
Boreal Toad	S	Y	P	Y	P	Breeding habitat occurs in lakes, ponds and slow streams. Breeding habitat is absent in analysis area.
Pine marten	MIS	Y	P	Y	N	Mature spruce-fir forest with at least 30% canopy cover, plentiful fallen logs and a lush understory of shrubs and forbs. No existing habitat present.
Pileated WP	MIS	Y	P	Y	P	Mature forest with large live trees for cover, large dead nest trees and large downed woody material for feeding. Limited habitat available.
Elk	MIS	Y	Y	Y	Y	Winter, early spring seasonal habitats exist.
Coeur d’Alene Salamander	S	Unk	N	Y	N	Springs and seeps, waterfall sprays zones, damp streambanks in talus or fractured rock sites up to 5,906 feet. No habitat in analysis area.

[1]**ST = Status**; **T**=Federally Threatened; E=Federally Endangered; **RD**=Recently delisted, likely to be listed as Sensitive; S=Forest Service Region 1 listed as Sensitive; MIS= Bitterroot National Forest Management Indicator Species. **Presence; Y**=Yes; N=No; P=Probable (based on known habitat requirements); Unl=Unlikely (based on known habitat requirements; Unk=Unknown; **S**= Seasonal.

Threatened and Endangered Wildlife Species

The U.S. Fish and Wildlife Service (FWS) list the grizzly bear, bald eagle, and lynx as threatened wildlife species that could occur on the Bitterroot National Forest. There are no documented occurrences of these species within the analysis area. The only listed threatened or endangered wildlife species with potential habitat in the analysis area is lynx and wolf.

Suitable lynx habitats have been mapped in the analysis area but suitable habitat of lynx will not be affected because only burned Douglas-fir and ponderosa pine habitats would be harvested. Wolves are not known to use the analysis area but wolves have been detected in nearby drainages and the presence of big game could attract foraging wolves in the future. The project file includes additional details of species descriptions and habitat components.

Sensitive Species

The Bitterroot National Forest lists peregrine falcons, Townsend's Big-eared bats, Northern Bog Lemmings, Black-backed woodpeckers, Coeur d'Alene Salamander, fisher, Flammulated owls, Northern goshawks, Northern leopard frogs, Boreal toads, and wolverine and Harlequin ducks as sensitive species. Of these, only black-backed woodpeckers have potential to be affected by proposed activities. The other species are either not present or reside in habitats that would not be affected by the proposal (refer to Table 3-27). See project file for additional details of species descriptions and habitat components.

Black-backed Woodpecker (*Picoides arcticus*)

Black-backed Woodpeckers are opportunistic feeders typically associated with mid- to higher elevation coniferous forests in the northern Rocky Mountains. This species is highly mobile and tends to concentrate in areas of bark beetle outbreaks, usually associated with stand-replacing fires. They are rarely seen except in recent burns. Beetle outbreaks typically decrease within three years (at least where fire was the cause of tree mortality), and concentrations of these birds then move on to other foraging opportunities. Black-backed Woodpeckers seem to be more strongly associated with beetle outbreaks in fire-killed trees, whereas the closely related Three-toed Woodpecker (*Picoides tridactylus*) tends to be more closely tied to non-fire related beetle outbreaks. There is considerable overlap between the two species. There is little data available on the number of dead trees or the size of tree mortality centers needed to attract either of these species (Hutto, pers. comm.).

Hutto has found that Black-backed Woodpeckers prefer fire-killed Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*) and ponderosa pine (*Pinus ponderosa*), whereas lodgepole pine (*Pinus contorta*) is a secondary species. Weydemeyer and Weydemeyer (1928) also list Douglas-fir as the birds' preferred species. Black-backed Woodpeckers usually forage on larger diameter trees, probably because larger trees are more prone to beetle attack. They are stronger drillers than many other woodpeckers, so are capable of excavating in harder wood and through thicker bark than other species.

Snag concentrations seem to be more critical for winter foraging than for summer foraging. Small flocks of Black-backed Woodpeckers often seen in snag concentrations in the winter seem to disperse during the summer, probably due to territoriality associated with nesting.

Black-backed Woodpeckers excavate nest cavities in live or dead trees in close proximity to foraging areas. They nest relatively close to the ground (3-16 feet) in trees larger than 12 inches DBH. Clusters of snags provide both nesting and foraging habitat. This species is currently foraging in nearly all units within the analysis area but nest locations have not been identified.

Management Indicator Species

The Forest Plan identifies three wildlife indicator species, elk, for species commonly hunted; pileated woodpeckers, for old growth habitat at low to middle elevations; and pine marten, for mature and old growth habitat at middle to high elevations. Only elk are likely to be affected by the proposed activities. Pileated woodpeckers have very limited habitats in the analysis area and those that do exist would not be affected by the proposal because no management activities are proposed in their habitat. Similarly, pine marten habitats are very limited and would not be affected by the proposal because no management activities are proposed in their habitat. See project file for additional details of species descriptions and habitat components.

Elk (*Cervis elaphus*)

Population

The analysis area lies within Montana Department of Fish, Wildlife and Parks Hunting District 270. Spring counts in the area have documented a steadily increasing population in the general winter range area. The population increase can be attributed to a reduction of antlerless elk permits. Bull harvest has also been restricted to brow-tined bulls since 1991 (MTFWP, 2001). In addition the wildfires of 2000 removed a substantial amount of conifer cover thereby allowing an ever-increasing development and availability of forage.

Since the 1991 hunting season, regulations have prohibited the harvest of bulls lacking a brow-tine. The result is a reduction in total bull harvest, and an increase in the number of branch antlered bulls available to hunters. Recruitment, as measured by calf/cow ratios has been within the range expected for elk in the northern Rockies, from 70/100 in 1995 to 39/100 in 2003 (MTFWP, 2001). The elk herd seems to be in good shape and progressing toward the Management Goal of the Montana Elk Management Plan (MTFWP, 1992), FP Monitoring Report (draft) 2003.

The most recent data available from the statewide questionnaire indicates that the percentage of the bull elk harvest that occurs during the first week of the season is within the Forest Plan standard of less than 40 percent for three years running.

Elk Habitat

According to the Guides for Elk Habitat Objectives (USDA, 1978) optimum habitat proportions for elk are as follows in Table 3-28.

Table 3- 28 Elk Habitat Proportions (percent)

Habitat Component	Optimum Winter Range Proportions (%)	Proportions in Analysis Area (%)
Open Forage	20	85
Forested Forage	40	<10
Hiding Cover	15	<5
Thermal Cover	25	<1

Winter range lacks thermal cover; the Forest Plan EIS Record of Decision establishes a minimum of 25 percent of winter range as thermal cover. Total cover is well below the recommended range of 30 to 50 percent for winter range due to wildfires of 2000. Bark beetle mortality within the analysis area is expected to further reduce total cover.

Elk Habitat Effectiveness (EHE)

The Forest Plan requires that we manage roads through the Travel Plan process to attain or maintain 50% or higher elk habitat effectiveness (Lyon, 1983) in currently roaded third-order drainages. The three third-order drainages in the analysis area are 03b302-4, and 03b301-6 and 03b301-4. EHE is based on the density of open roads that exist in an area during the period when elk are present and the cover/forage ratio. EHE is calculated by third-order drainage using a road density model developed by Lyon (1983, 1984).

Open roads were assumed to be those legally used by any motorized vehicle during the season when elk are using the area (winter). Roads which are closed to highway vehicles but open to motorized vehicles less than 40 inches in width (OHVs) except during the regular hunting season were considered open roads because studies show that elk use of areas near roads declines as a result of even minimal use by any motorized vehicle. Occasional use occurs on most of the seasonally closed roads within the analysis area, especially during the archery season.

Habitat effectiveness is a function of open road density and cover/forage and can be manipulated by changing the cover/forage ratio or managing the road system. In this cover limited post-fire landscape it will be easiest to manage access to maintain habitat effectiveness. Although total road density is relatively high and would exceed standards (EHE <50%) for habitat effectiveness if there were no travel restrictions, the seasonal closure of roads during periods when elk are present brings road density into compliance with the Forest Plan (See Table 3-29). Although seasonal closures meet the intent of habitat effectiveness permanent road closures or obliteration would improve habitat quality for elk in this burned and now cover-deficient analysis area.

Table 3- 29 Road Density by Third-Order Drainage

Third Order Drainage #	Total Road Density[1]	Open Road Density[2]	EHE
03b301-4	3.6	1.8	53
03b301-6	4.3	1.08	61
03b302-4	6.9	0.6	73

[1]Road Density = the miles of road per square mile of land.
[2] Roads open when elk are present (late fall/winter)

Elk Security

Security is defined as 250 (or greater) acre blocks of cover, one half mile or more from an open road. Because much of the analysis area was burned in 2000 adequate size blocks of cover are lacking. Elk security can be best provided for by managing motorized access. The existing seasonal and yearlong road closures currently meet the intent of elk security during the period when elk are present within the analysis area. The seasonal motorized travel restriction imposed on the Guide-Rye Road (#311, an arterial road that crosses through the analysis area) since the early 1990's provides a significantly improved level of big game security during general rifle season in the analysis area and this portion of the Sula District. This restriction effectively restricts many secondary roads that spur off from the Road 311.

Special Habitats

Snags

Snags are prevalent throughout the analysis area due to the wildfires of 2000. Snags provide foraging habitat for birds (as discussed above for Black Backed Woodpeckers) and also nesting habitat for cavity nesting species such as black-capped chickadees and nuthatches. Additional mortality and recruitment of snags is expected as a result of beetle activity throughout the analysis area. Although a variety of snag size classes are present within harvest units the immediate stands surrounding the harvest units are comprised of relatively young plantations or younger trees, some of which were also burned. Therefore large snag size classes are expected to be deficient in these immediately adjacent areas.

Old Growth

Old growth according to the Bitterroot National Forest Plan varies by habitat and landform. In general old growth consists of stands of live trees with 15 or more, large trees 20 inches in diameter at breast height, and canopy closure at 75 % of site potential. Heart rot and broken tops are often present. Mosses and lichens are also often present. Forest Plan standards require that stands be managed so at least 3% of each third order drainage in Management Area 1 be maintained in old growth, preferably in stands at least 40 acres in size. The Forest Plan requires that 8% of each third order drainage be managed for old growth in Management Area 2. Due to the wildfires of 2000 there are only 54 acres of old growth in the analysis area. There is no old growth habitat within any of the proposed harvest units and therefore old growth will not be affected by the proposed action.

Environmental Consequences

Some wildlife species will not be addressed in this analysis, as explained in Table 3-30.

Table 3- 30 Wildlife Species That Were Not Carried Forward Into the Effects Analysis

Species	Rational For Not Including in Effects Analysis
Bald Eagle	Habitat along rivers would be unaffected.
Grizzly Bears	Bears are not present in the analysis area and habitat for grizzly bears would not be affected by this project.
Gray Wolf	Prey is not limiting on the Bitterroot and although wolves have potential to forage in the analysis area they are not known to use this area and habitat and big game prey would remain unaffected by proposed actions.
Lynx	Field reviews indicate that there is no suitable or preferred habitat within proposed harvest units.
Peregrine Falcon	No potential nesting or foraging habitat is present.
Flammulated owl	Habitats would not be affected by proposal and surveys have not detected this species.
Harlequin Duck	No habitat exists in analysis area.
Townsend’s Big-Eared Bat	No maternal roosting habitat for the species in the project area and requirement for snag retention is included in project design.
Wolverine	No known habitat in project area.
Fisher	No known habitat in project area.
Northern Goshawk	There is no potential nest habitat in analysis area.
Northern Leopard Frog	Species is not present within the Bitterroot Valley. There are no slow moving or standing water bodies present in the project area.
Pine marten	No known habitat in project area.
Pileated Woodpecker	There is no potential foraging/nest habitat in proposed harvest units.
Northern Bog Lemming	There are no bogs that provide suitable habitat for the bog lemming.
Boreal Toad	There is no breeding habitats in project area and harvest would occur when toads are hibernating or not present in the area. See project file for additional details.
Coeur d’Alene Salamander	No habitat is present in the analysis area.

Effects Common to All Action Alternatives

All action alternatives retain all snags less than 10 inches dbh and snags greater than 10”at the levels specified in Table 2-4 (Management Requirements and Mitigation Measures, EA Chapter 2). The effectiveness of retaining snags at the proposed levels was predicted in the Burned Area EIS (2001) to meet species viability needs for snag dependent species. Implementation monitoring of snag retention in the Bitterroot BAR project indicates that we are meeting snag retention requirements at about a 90% level (J Ormiston, per com., 2003).

Total road density would be reduced under both action alternatives as a result of decommissioning 1.4 miles of road and placing 12.6 miles of road in storage thereby reducing access and improving elk habitat effectiveness. Although lifting the yearlong travel restriction on 1.6 miles of one road in third-order drainage 03b302-4 would increase open road density when elk are present, open road density would remain within the Forest Plan standard (approximately 62% EHE).

The action alternatives differ only slightly in their potential to alter snag and down woody habitats. Proposed harvest activities would remove a portion of existing standing and down woody material used by many species for foraging, denning, and nesting. Some wildlife species (e.g., elk) may be temporarily displaced during the implementation of the project.

There is no old growth in any of the proposed harvest units. No old growth will be affected by actions proposed in either alternative.

Alternative 1 No Action

Threatened and Endangered Wildlife Species
Under this alternative there would be no effect on wolves because wolves are not presently using this area. Elk, a wolf prey species would not be detrimentally affected by this proposal because forage is expected to increase and existing road closures are adequate to maintain habitat effectiveness for elk. Both thermal and hiding cover will recover as trees reoccupy the analysis area.

Although habitat has been mapped for lynx within the analysis area, field surveys indicate there is no lynx habitat within harvest units. Records and recent lynx surveys indicate there are no lynx present within the analysis area. The no action alternative would allow forest succession to proceed and would likely allow Douglas-fir to dominate the sites, due to loss of ponderosa pine seed sources. It is probable that a limited acreage of lodgepole might establish in the higher elevations. Recovering Douglas-fir habitats are unlikely to provide an appreciable amount of lynx foraging habitat. The high level of future down wood may provide some den habitat but this would also be marginal due to the distance of this habitat component from preferred lynx foraging habitats. There would be no effect to lynx from implementing this alternative.

Sensitive Species
Black-backed woodpeckers are present throughout all harvest units. Foraging activity has been documented on nearly all tree size classes. With no action, maximum habitat values would be maintained for a suite of species dependent on snags and down woody material (woodpeckers, small rodents, and ground squirrels). Snags would remain at current levels and would provide high quality foraging and nesting habitat for some of the cavity-dependent wildlife. The quality of foraging habitat would decline as fire-killed trees fall and as fire-related insect activity decreases. The majority of snags are expected to fall within the first 10 to 15 years after the fire (Lyon, 1977). The high intensity burn areas represent 95 percent of the analysis area.

Management Indicator Species
Over time some areas may become densely tangled with tree boles that may preclude or limit use by larger ungulates and may therefore limit the use of some areas for forage by big game. However, this is not expected to negatively affect the elk population because of the extensive area of forage that is expected to develop following the fires of 2000. The expected accumulation of woody material would provide den and nest habitat for small and medium sized predators and their prey. For the remainder of the area that experienced low intensities, trees would continue to die and replace current snags as they fall. There is expected to be some shift in species that utilize the area following the 2000 fires. Species that prefer more open habitats and edge species are expected to increase in numbers.

Under this alternative existing seasonal road closures would maintain an adequate standard of elk habitat effectiveness. Elk population monitoring (MTFWP, 2003) indicates that elk populations are increasing throughout the Bitterroot Valley including Unit 270 and the inclusive Lyman analysis area. The existing open road density and lack of cover due to wildfire does not appear to be affecting the ability of this population to survive and thrive. It is possible that there may be a need to work with MTFWP to assess season hunt periods and or consider additional travel restrictions if monitoring detects elk population declines.

Snags
Under this alternative snags would remain at natural levels and provide the highest amount of available niches and habitat features for snag dependent species.

Alternative 2

Threatened and Endangered Species
The effects on wolves would be the same as described above for Alternative 1 because wolves are not present and Alternative 2 would not negatively affect wolf prey species.

Although habitat has been mapped for lynx within the analysis area, field surveys indicate there is no lynx habitat within harvest units. Records and recent lynx surveys indicate there are no lynx present within the analysis area. Proposed harvest actions and related prescribed fire use and road treatment actions would not affect suitable lynx habitats. Therefore, this project may affect but is not likely to adversely affect the lynx. Additional details and rationale can be found in the biological assessment (project file).

Sensitive Species

Black-backed woodpeckers are present throughout all harvest units. Foraging activity has been documented on nearly all tree size classes. Alternative 2 would remove snags and temporarily open some road segments, including the construction of 1300 feet of temporary road into Unit 5. The temporary nature of this road segment would cause some immeasurable effects because it would be native surface material and receive short-term use and be immediately reclaimed after use. Alternative 2 would maintain snags at levels necessary to provide species viability across the Bitterroot National Forest as determined in the Burned Area FEIS (2001), for black-backed woodpeckers and other cavity nesting bird species. As reported therein (BAR FEIS, page 3-513) over 300,000 acres of snag habitat was created on the Forest following the 2000 fires. Over 99.99% of this habitat still exists following the salvage allowed in the BAR Settlement Agreement, so habitat is not presently considered a limiting factor for black backed woodpeckers. However, full snag habitat potential would probably not be realized under this alternative in the project area because large snags would be removed, affecting both future standing and down wood.

Even though some of the roads are already closed yearlong, the decommissioning of 1.4 miles of road would reduce disturbance to wildlife species because decommissioning would eliminate the unmeasured (likely to be infrequent) road closure violations that occur when OHVs travel around road closure barriers. Proposed road storage on those roads currently restricted by seasonal closures would reduce future potential loss of retained down and standing woody material that is occasionally accessed by firewood cutters.

Total road density in third-order drainage 03b302-4 would be reduced to 6.6 miles per square mile but open road density would remain the same because the roads to be decommissioned already have yearlong restrictions on them. However, approximately 12.6 miles of road would be placed in storage, which would reduce gathering of firewood along those roads and thereby retain higher levels of both standing and down wood enhancing habitat quality for dead wood dependent wildlife species.

Management Indicator Species

Alternative 2 would remove snags and temporarily open some road segments, including the construction of 1300 feet of temporary road into Unit 5. The temporary nature of this road segment would cause some immeasurable effects to big game because it would be native surface material and receive short-term use and be immediately reclaimed after use.

The proposed action would have no to little effect on thermal or hiding cover for elk. Green tree harvest removes trees already infested with beetles that are dying from insect attack. Removal of this habitat component may reduce cover sooner than if trees are allowed to die without cutting. However, removing infested trees may help to reduce beetle activity at the local level and reduce further losses of cover due to beetle activity.

Removal of mistletoe-infested trees (sanitation cutting) however has the potential to further reduce hiding and/or thermal cover for elk in the analysis area. However, only three units have been identified for treatment totaling approximately 20 acres. About 5 acres of the 20 acres has some potential as thermal cover (70% canopy closure). Nearly all identified sanitation treatment areas are heavily infested with beetles and many of these trees can be expected to be lost to beetle kill. A limited amount of hiding cover is also present and is expected to be affected by beetle induced tree mortality. In summary, thermal and hiding cover characteristics are limited in the proposed treatment areas and any treatment would affect less than 1 percent. Field reviews by a wildlife biologist prior to treatment and mitigations to mark and retain thermal or hiding cover vegetation likely to survive will curtail any further loss of hiding and thermal cover.

Reforestation activities would decrease the time it takes for trees to regrow and would reduce the amount of time needed for potential snag replacement trees to develop. Planting would speed recovery of thermal and hiding cover for elk.

Snags
Alternative 2 would maintain snags at levels necessary to provide species viability across the Bitterroot National Forest as determined in the Burned Area FEIS (2001), for black-backed woodpeckers and other cavity nesting bird species. Full habitat potential in the project area would probably not be realized under this alternative because large snags would be removed from the analysis area affecting both future standing and down wood.

Alternative 3

Effects of alternative 3 are similar to those described for alternative 2. Under alternative 3 however more snags would be retained because less acreage would be treated under this alternative. Effects to big game thermal and hiding cover would remain the same as Alternative 2. Elk habitat effectiveness as it relates to thermal cover, hiding cover, and open road densities would be the same as Alternative 2.

Since this Alternative treats approximately 191 fewer acres than Alternative 2, alternative 3 would provide a slightly improved level of habitat quality across the analysis area for black-backed woodpeckers. The effect on viability will be similar to the proposed action as noted above. This alternative stores and decommissions the same sections and miles of road as alternative 2.

Effects on thermal and hiding cover related to removal of mistletoe infected trees would be the same as described for alternative 2.

Reforestation activities would decrease the time it takes for trees to regrow and would reduce the amount of time needed for potential snag replacement trees to exist. Planting would speed recovery of thermal and hiding cover for elk.

Cumulative Effects

Analysis Area
The cumulative effects analysis area consists of three third order drainages (map in project file) that encompass the activity units and road storage/decommissioning. These are chosen because they encompass an area most likely to provide habitats likely to be used by or within the home range of the most far-ranging species of concern, elk.

Described below are several activities and natural events within the cumulative effects analysis area that already have occurred, or are reasonably foreseeable in or near the project area. The past activities and natural events have contributed to create the existing condition described previously. The activities listed below may produce environmental effects on wildlife by affecting habitat or the species. The most likely aspects of habitat to be additively affected by these actions are standing and down wood habitat and increasing levels of disturbance to disturbance-sensitive species. Other features of habitat are unlikely to be cumulatively affected by the proposed actions because fire has temporarily eliminated live tree habitat characteristics and therefore habitat for many species.

Past, ongoing, and future activities that might affect the wildlife resource in the analysis area (Vegetation altering activities)

- Effects of the 2000 fires (changed conditions)
- Forest Service grazing allotments (East Fork, Sula Peak, and Shirley Mountain)
- Pre-2000 timber harvest (Forest Service, state, and private)
- Post-2000 Sula State Forest salvage harvest
- Post-2000 Forest Service salvage harvest (Elk Point I, Elk Point II, Little Bull, Big Bull, Bitter Camp, and Guide salvage sales)
- Post-2000 salvage harvest on private lands
- Fire Suppression
- Firewood gathering
- Douglas fir bark beetle infestations and potential future harvest of beetle killed trees.
- Tree planting activities
- Jennings small timber sale
- Weird salvage sale

Since the fires of 2000, nearly all of the lands in the Sula State Forest in French Basin have been salvage harvested. National Forest salvage harvest started in the upper rim of French Basin in February 2002 (Elk Point I and II sales), and continued through summer 2002 (Elk Point I, Little Bull, and Big Bull sales), and winter 2002-03 (Guide and Bitter Camp sales). Small areas of salvage harvest were completed in the Elk Point I, Big Bull, Guide, and Bitter Camp sales during summer 2003. The remaining areas primarily consist of small, helicopter-yarded units using existing landings. With the use of expanded RHCA buffers (200-300 foot protection widths around all streams) and snag retention mitigations the harvest areas contain adequate snags to ensure species viability for all wildlife species present on the Bitterroot that use snag habitats. Snag levels on State lands however are lower and many of the largest snags have been removed. Small areas of private salvage harvest occurred in the Cameron and Lyman Creek drainages since the fires of 2000. These sales typically removed nearly all of the burned snags creating voids of habitat for cavity nesting wildlife species.

Firewood gathering can be predicted to remove appreciable amounts of larger wood along road systems, even if open seasonally, further reducing the available woody material for wildlife. The overall cumulative impact on wildlife is a gradual reduction in larger down and standing woody material within 200 feet of road systems (unpublished report in draft, Bates 2002). The ultimate impact of these activities is not known but can be predicted to degrade habitat quality for local populations of a variety of ground dwelling and arboreal mammal species such as ground squirrels and red squirrels. Species viability however is not expected to be at risk because there are many acres of burned habitats on the Bitterroot NF that will not be affected by harvest actions and all federal harvest activities require the retention of standing and down wood material in all size classes.

The overall impacts of grazing within this analysis area is similar to other allotments on the Forest which indicate grazing levels are relatively low and are not affecting the overall ability of the landscape to produce forage for large ungulates or smaller rodents and invertebrates. Livestock grazing in the Lyman area does not appear to deter or displace wild ungulates from the area.

There are no indications that past and ongoing herbicide spraying is having a negative effect on wildlife species or negatively affecting habitats. Long-term effects are expected to be positive for wildlife as native grasses and forbs are able to replace the weed species.

Vegetation altering activities have modified habitats principally by removing structural habitat components such as large snags or setting back or speeding plant succession. The cumulative effects of past activities on species have most likely caused species that favor a particular vegetative stage to abandon certain areas. There is also a high likelihood that past removal of large trees and snags removed a portion of available nesting habitats for larger bird species, such as pileated woodpeckers. Although these past actions may have reduced the amount and quality of these habitat components in the analysis area and more than likely displaced some species, it is evident from pileated surveys on the forest that pileated woodpecker populations remain viable (Bitterroot National Forest Plan Monitoring Report, 2003).

Potential Wildlife Disturbance Activities

- Outfitter and guide activities
- Mushroom and special products harvest
- Increasing levels of recreational use and travel on system roads and at dispersed sites

The level of the above disturbance causing activities within the analysis area are minimal and appear to cause only short-term displacement with no apparent effect on species viability. Most disturbance causing activities within the analysis area are negligible and occur at low or very low levels. However, motorized access opportunity is relatively high within the analysis area and OHV trails occur occasionally in the Cameron, Lyman, and Guide Creek drainages. OHV use in the area is low. One OHV route was recently blocked and made inaccessible as part of the Guide Timber Sale. OHV routes typically follow ridges, natural pathways for many dispersing wildlife species. Total road density is relatively high in the analysis area, but open road density during the season when elk are present is within standards set for the Bitterroot National Forest. Motorized access most likely causes stress in some wildlife species (elk, deer) such that they are temporarily displaced to other areas (Rost, G. R. and J. A. Bailey. 1979). The seasonal motorized travel restriction imposed on the Guide-Rye Road (#311, an arterial road that crosses through the analysis area) since the early 1990's provide a significantly improved level of big game security during general rifle season in the analysis area.

Dispersed campsites are scattered throughout the analysis area, but recreational use is generally light and confined to main roads. This can be expected to increase as the valley population grows and valley residents search for less crowded recreational areas. Hunting season brings increased road use including OHV use. Some OHV use occurs throughout the summer but summer use is considered negligible. The current overall impact on wildlife is a minor level of displacement for big game. And although the fires of 2000 removed significant amounts of vegetative cover thereby allowing greater sighting distances, less noise reduction, and more visibility for both wildlife and hunters big game Forest Plan objectives for elk numbers and hunters are still being met (FP Monitoring Report (in draft) 2003).

In summary, cumulative habitat altering and disturbance effects when considered together are predicted to be primarily wildlife displacing impacts. The application of constantly improved mitigations and standards such as road closures and down and standing wood retention guidelines continue to raise habitat quality over time.

Based on the above, the cumulative effects would be similar under each of the action alternatives. Alternative 2 treats more acres thereby reducing large snags across the area but also decommissions 1.4 miles of road and stores 12.6 miles thereby reducing access to snags and down wood by woodcutters. Restricting motorized access on roads also reduces human induced disturbance that can displace wildlife temporarily from the area. Alternative 3 conducts salvage harvest on fewer acres and decommissions and stores the same mileages of road as Alternative 2. The effects between the two alternatives are similar in nature but generally fewer for Alternative 3. Each action alternative contains features that preserve elk habitat and black-backed woodpecker habitat values and both maintain species viability for black-backed woodpeckers and elk across the analysis area.

Consistency with the Bitterroot Forest Plan and Other Regulation

Forest Plan Standards

The Forest Plan directs management to retain 25 percent of the big game winter range in thermal cover (specified in the Forest Plan Record of Decision, 1987) and maintain elk habitat effectiveness at a minimum 50% level (2 miles of open road or less per square mile). Standards also require the retention of snags and other habitat components such that all native and desired non-native species populations remain viable. Other Forest Plan standards related to maintenance of wildlife populations include standards for amount and distribution of old growth habitat. All alternatives comply with Forest Plan Standards through design criteria and existing road closures. Although thermal and hiding cover are currently below standards, the action alternatives would retain these habitat components unless trees have been identified as dead or dying. If trees are dying thermal and hiding cover properties would have been lost anyway. Treating or harvesting such areas in the long-term may limit further beetle mortality on remaining trees within stands treated, thus preserving long-term hiding and thermal properties.

Alternative 2 and 3 also obliterate 1.4 miles of road currently seasonally closed and thereby enhances habitat values for several wildlife species. Alternative 3 conducts salvage on fewer acres and maintains existing road density through seasonal road closures.

All action alternatives are consistent with applicable regulatory direction.